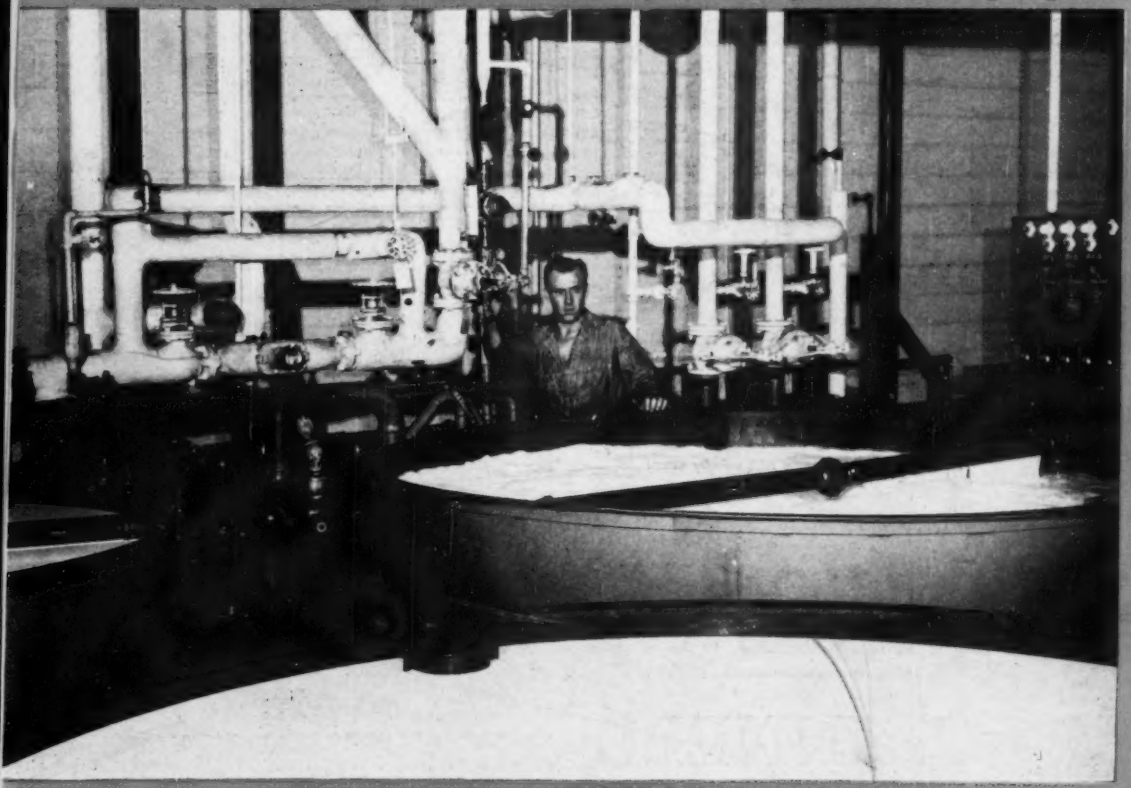
Heating Piping & Air Conditioning

DESIGN
INSTALLATION
OPERATION
MAINTENANCE

OCTOBER ★ 1952

INDUSTRIAL
COMMERCIAL
INSTITUTIONAL AND
PUBLIC BUILDINGS

Page 125—Journal Section of The American Society of Heating and Ventilating Engineers



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FOR CLASSY SHOPS

. . . OR BUSY PLANTS

THERMOLIER UNIT HEATERS

The condensed table below is a quick guide to the selection of the correct Thermolier for specific conditions. The capacities, when motors are operating at normal speeds, are based on Standard Basis of Rating: 2 lb. steam pressure and 60° F entering air temperature.

Grinnell Thermoliers are tested and they are rated in strict accordance with rules of the Industrial Unit Heaters Association.

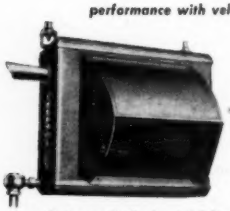
All Thermoliers can be operated at working steam pressures up to 125 psi and steam temp. up to 406° F.

A MODEL AND SIZE FOR EVERY PURPOSE

horizontal delivery

textile (horizontal delivery)

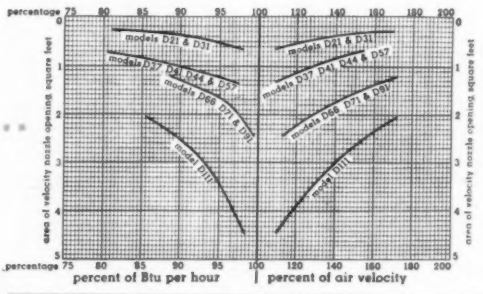
vertical delivery



velocity nozzle (horizontal delivery)

model	total heat delivered, Btu per hr	sq ft edr (nominal)	air velocity at exit, louvers open, lin. ft. per min.
horizontal delivery			
D21	35,600	148	786
D31	48,700	203	851
D37	62,200	259	753
D41	71,000	295	901
D44	84,100	350	887
D57	101,300	422	1016
D66	128,700	536	779
D71	151,700	632	977
D91	196,000	817	985
D111	275,300	1147	1048
Textile			
TX70	69,800	291	826
TX110	113,700	474	877
vertical delivery			
VA1042	50,800	212	1399
VA1045	73,600	307	1287
VA1065	109,400	456	1354
VA1075	145,600	607	1231
VA1101	185,000	770	1495
VA1111	257,000	1071	1631

performance with velocity nozzle ▶


percentage 75 80 85 90 95 100 120 140 160 180 200
models D21 & D37
models D37 D41 D44 & D57
models D66 D71 & D91
model D111
models D21 & D31
models D37 D41 D44 & D57
models D66 D71 & D91
model D111
area of velocity nozzle opening square feet
0 1 2 3 4 5
percent of Btu per hour
percent of air velocity

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THERMOLIER UNIT HEATERS

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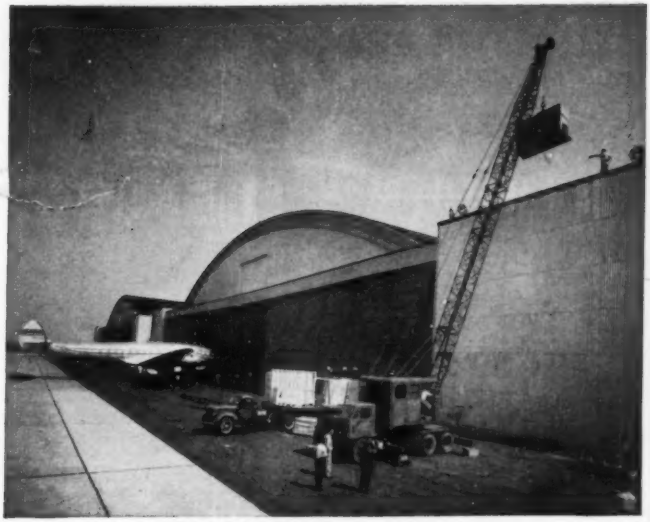
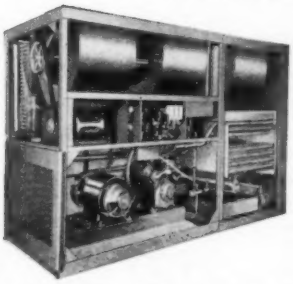
Manufacturer of: pipe fittings • welding fittings • forged steel flanges • steel nipples • engineered pipe hangers and supports Thermolier unit heaters • Grinnell-Saunders diaphragm valves • prefabricated piping • Grinnell automatic fire protection systems



Two 20-Ton Air Conditioning Systems Beat the Heat for Pan American Office Employees

Installation of central station units made in record time of three weeks



More than 500 Pan American World Airway employees spent the summer in cool comfort, provided by two 20-ton USAIRCO Model RK air conditioning systems. Installation of the two units was completed in the short space of three weeks, according to Abe Gollon, of Rimco Refrigeration Corp., Elmhurst, New York, who designed and installed the systems.

The units cool Pan American's communications, dispatch and general offices, which occupy the upper floors of two windowless structures between hangars at the Port of New York Authority's Idlewild International air terminal.

The new air conditioning equipment replaces existing ventilating systems and has been installed in enclosed penthouses—one on the roof above the general offices and the other in an engine room at office level. Ductwork for the system has been installed by A. Suna & Company.

In commenting on the Pan American installation, Mr. Gollon stressed the advantages of speed and economy in a self-contained system.

"Great savings in cost, time and space are effected by the use of this type of equipment which eliminates the need for extensive and expensive plumbing and electrical work inherent in a built-up system", he said. "Preliminary estimates for this installation using separate components located in various parts of the building ran considerably above the cost of the USAIRCO packaged units and would have made it impossible for us to complete the job on schedule."

See your nearest USAIRCO agent or write to Dept. HP 102

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Vol. 24 No. 10

(with which is merged the Aerologist)

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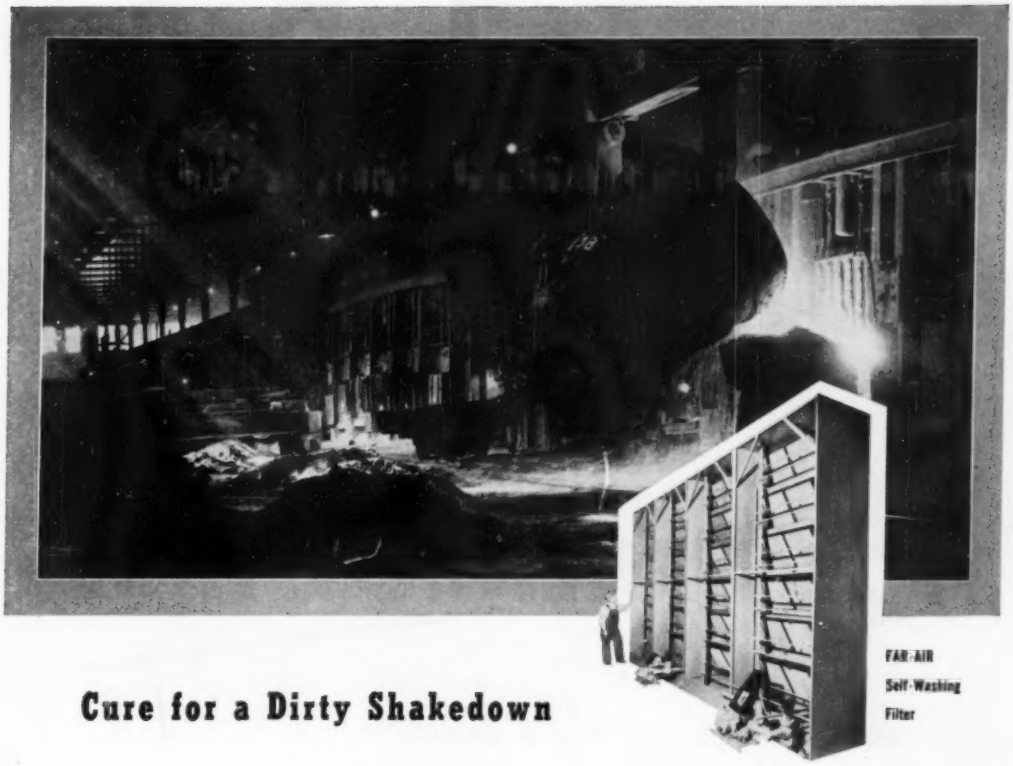

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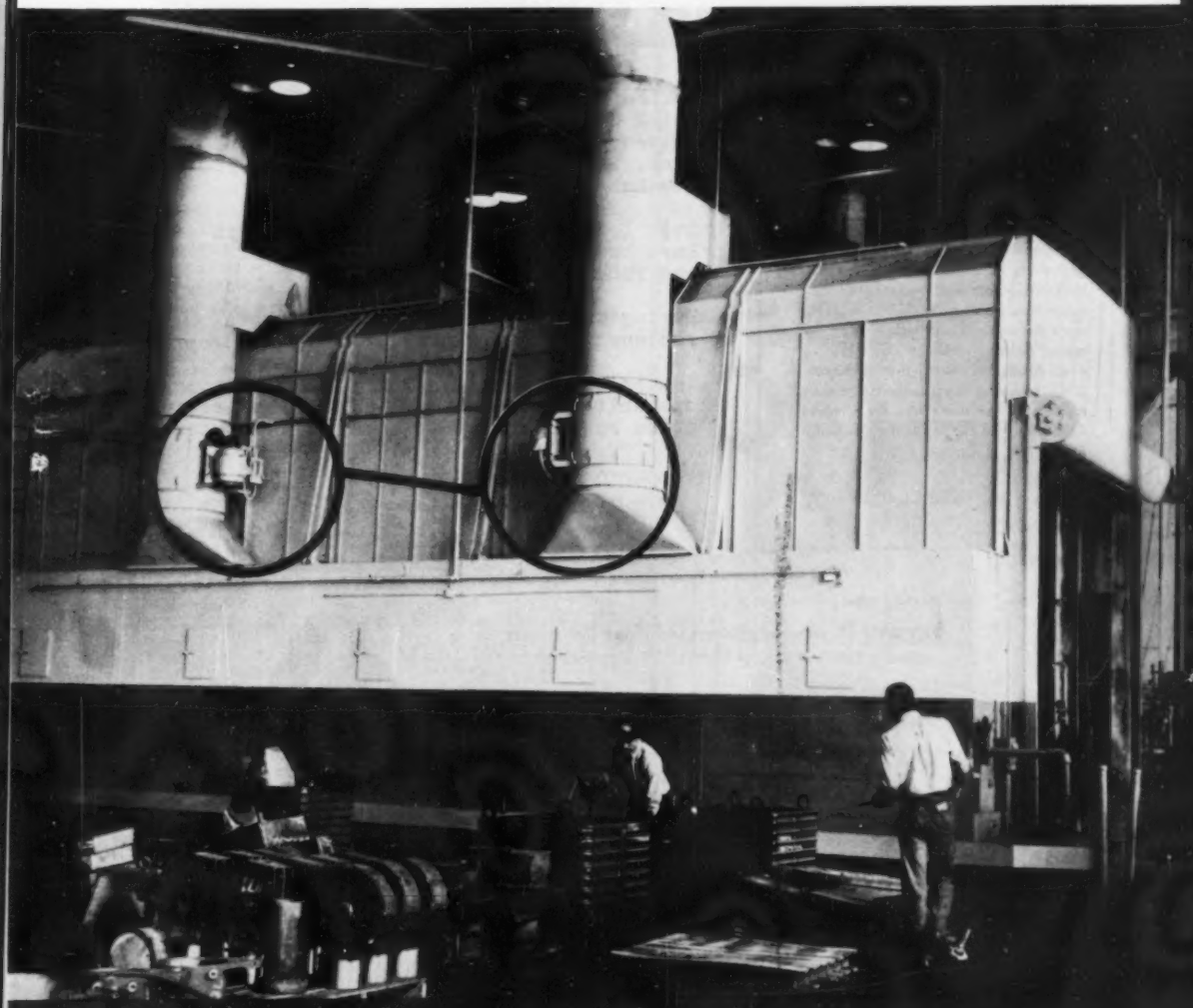

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CHIEF ENGINEER tells *why*

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"...For thirty-one years, we have been using Sarco type H radiator traps, radiator valves, float-thermostatic steam traps, etc., in the Northern Hotel, which now has 300 rooms.

Over 1,281 Sarco type H radiator traps have been in service since the hotel was rebuilt in 1941.

During the ten years to date, we have replaced not more than a half-dozen elements.

That's why we again ordered Sarco heating specialties for the 1951 addition of sixty-three rooms. We won't accept substitutes.

William Hillner

WILLIAM HILLNER
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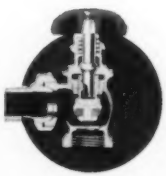
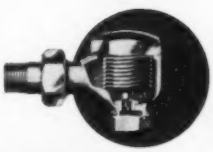
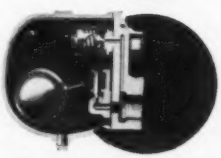


Sarco Radiator Valve No. 1141.



Sarco Radiator Trap, type H. Made with the famous Sarco Bellows; seamless, heavy wall, helically corrugated.



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The carefully engineered SARCOSTAT SYSTEM shown diagramatically in Fig. 1 fulfills these requirements perfectly. Many are now in successful operation.

The heart of the system is the Sarcostat hydraulic-electric control valve (Fig. 1) installed in the main steam supply line to each zone and positioned by the combined effect of the outdoor temperature and the influence of steam pressure existing on the downstream side of the valve.

Successful operation is predicated on careful sizing of orifice plates in each radiator or convector, which is part of the engineering service provided by Sarcotherm.

If you are seeking trouble-free heating control of steam systems of any size or type, we shall be glad to place our experience at your disposal without obligation.

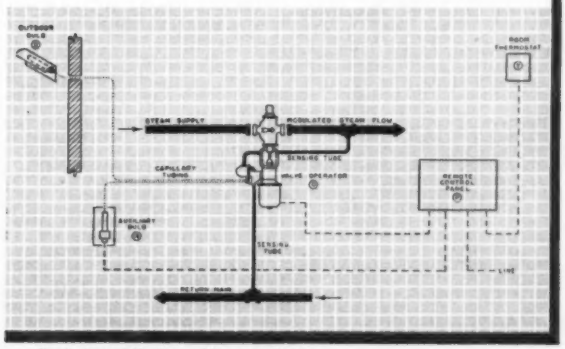

Fig. 1, Typical Hook-up of Sarcostat System.

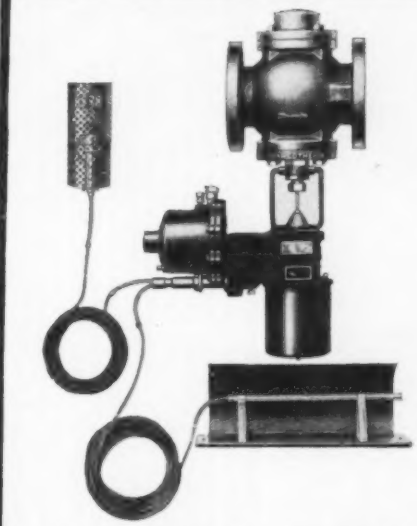

Fig. 2, Sarcostat Modulating Control Valve, Type W-1.

Fig. 3, Type W Manual remote Control Panel is equipped with temperature adjusting knob for "warmer" and "cooler," also a four-position Selector Switch for "Automatic," "Full Heat," "Heat Off," and "Summer."

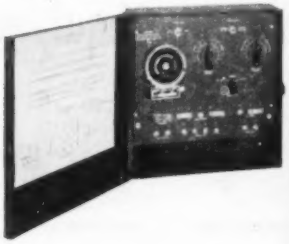

Fig. 4, Type WSA Remote Program Control Panel, adds to the features of type W a time clock to provide automatic morning pickup and night setback, and other features as specified.

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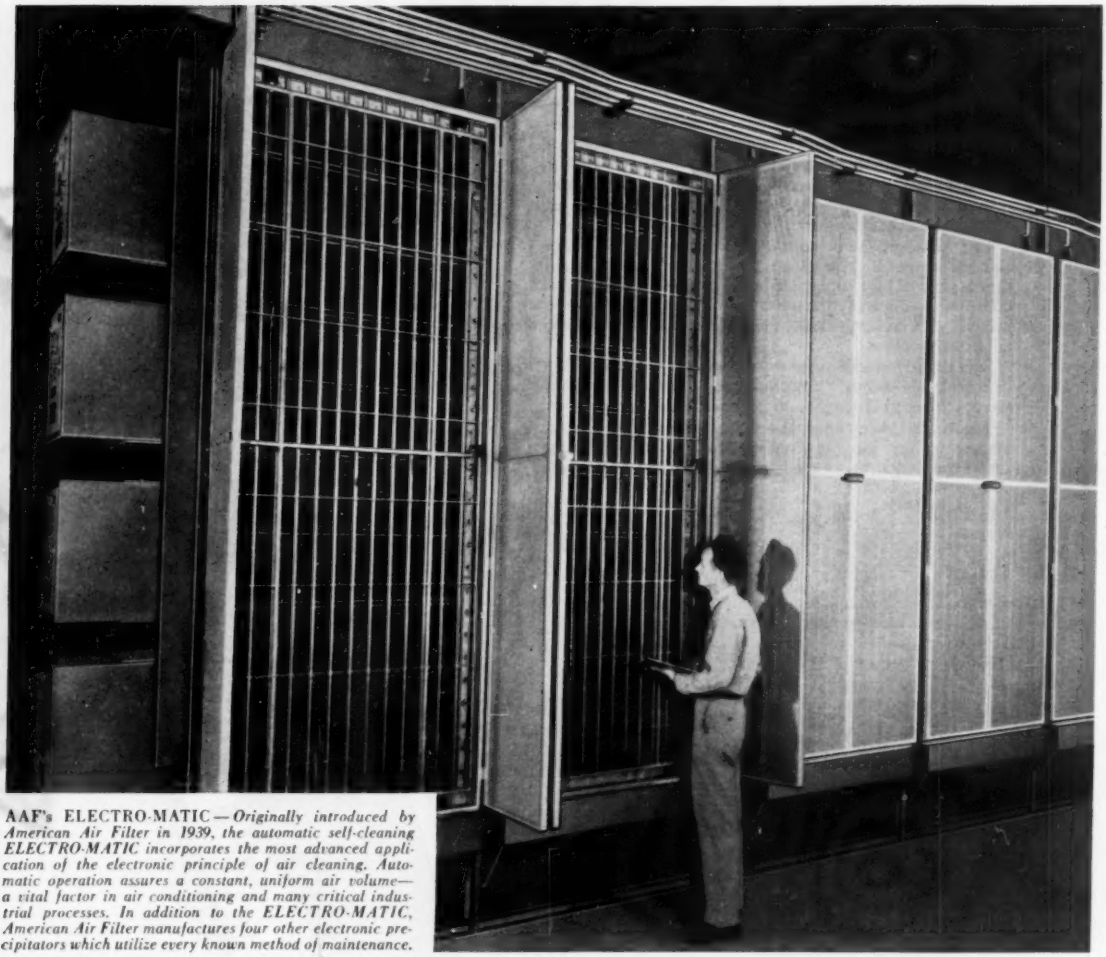
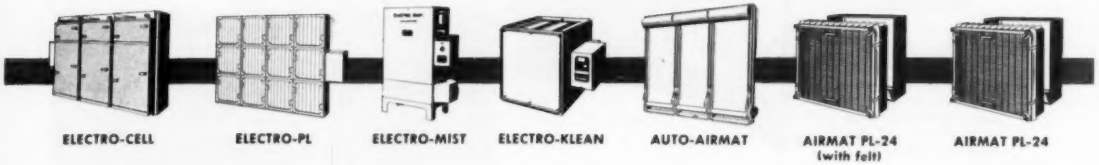
Why five types of

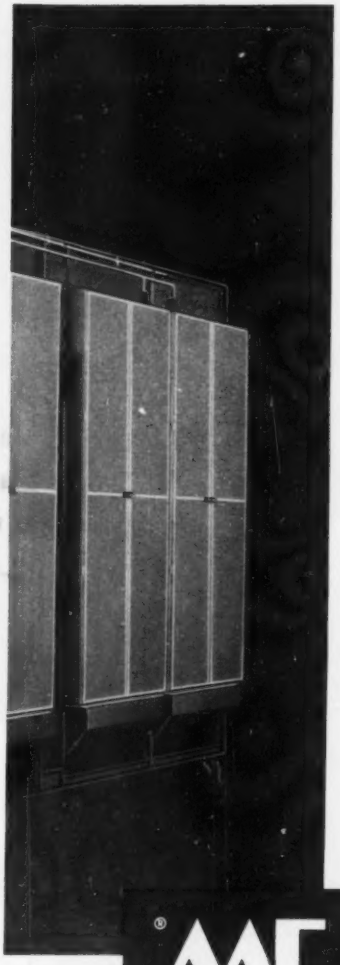


AAF's ELECTRO-MATIC — *Originally introduced by American Air Filter in 1939, the automatic self-cleaning ELECTRO-MATIC incorporates the most advanced application of the electronic principle of air cleaning. Automatic operation assures a constant, uniform air volume—a vital factor in air conditioning and many critical industrial processes. In addition to the ELECTRO-MATIC, American Air Filter manufactures four other electronic precipitators which utilize every known method of maintenance.*

a single source for all air cleaning equipment . . . . . .



electronic air cleaners?



AAF's five distinct types of electronic precipitators have highly individual characteristics . . . for a reason! As part of AAF's complete line of air cleaning equipment, they were developed to meet complex and distinctly different air cleaning requirements for fine particle size in both commercial and industrial application. As a result, the engineer is given the opportunity to *select* from a wide range of performance characteristics, rather than to be restricted to one type of electronic precipitator and try to make it fit the job.

AAF's group of five electronic precipitators offer these selective features:

- Different Efficiency Ratios
- Several Methods of Maintenance
- Variety of Space Requirements
- Wide range of sizes and air volumes
- Practical and realistic range of initial costs

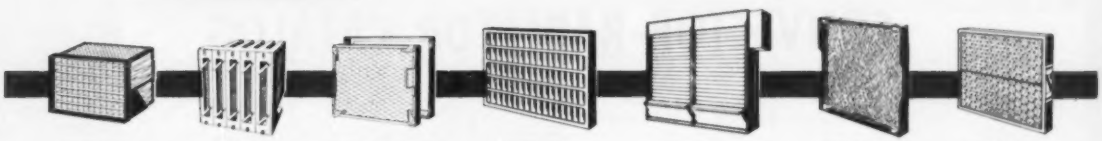
In addition to manufacturing the only complete line of air cleaning products, AAF's engineering staff is recognized as the leading authority in this field. The specialized knowledge of these men can save you time, effort and expense. If you have a dust problem, let us help you solve it.

Complete engineering data on all AAF equipment is available. Contact your nearest AAF representative, or write American Air Filter Company, Inc., 373 Central Avenue, Louisville 8, Ky.

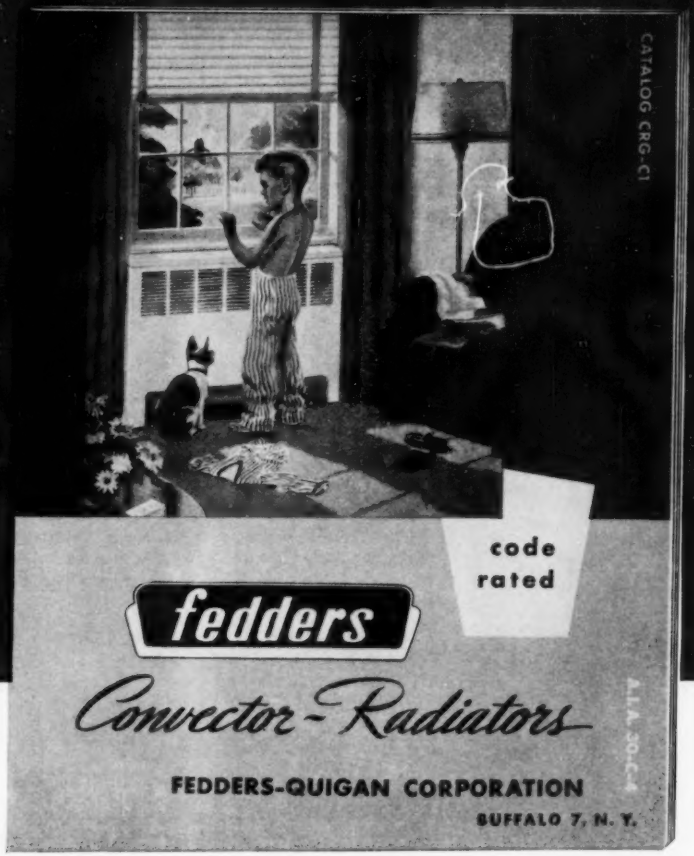
American Air Filter
COMPANY, INC.

373 Central Avenue, Louisville 8, Ky.

American Air Filter of Canada, Ltd., Montreal, P. Q.
Pacific Division Office, San Francisco, California



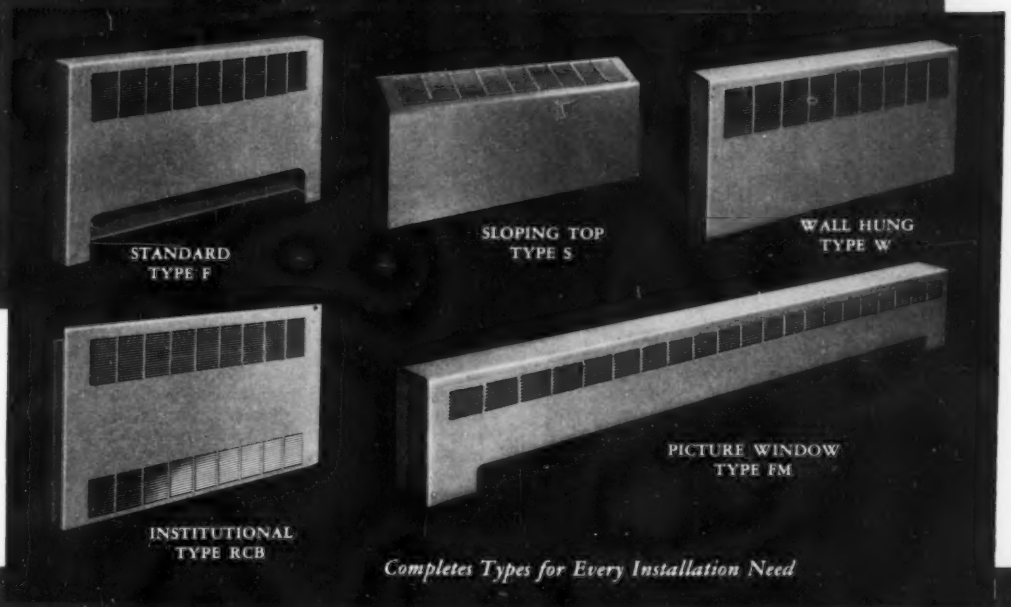
EVERY HEATING MAN SHOULD HAVE



IT'S fedders NEW AND COMPLETE CONVECTOR-RADIATOR CATALOG

FEDDERS-QUIGAN CORPORATION
57 Tonawanda St. Buffalo 7, N. Y.

THIS VALUABLE NEW WORKING TOOL



Completes Types for Every Installation Need

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Kindly send____copies of new Convector-Radiator Catalog addressed to my personal attention.

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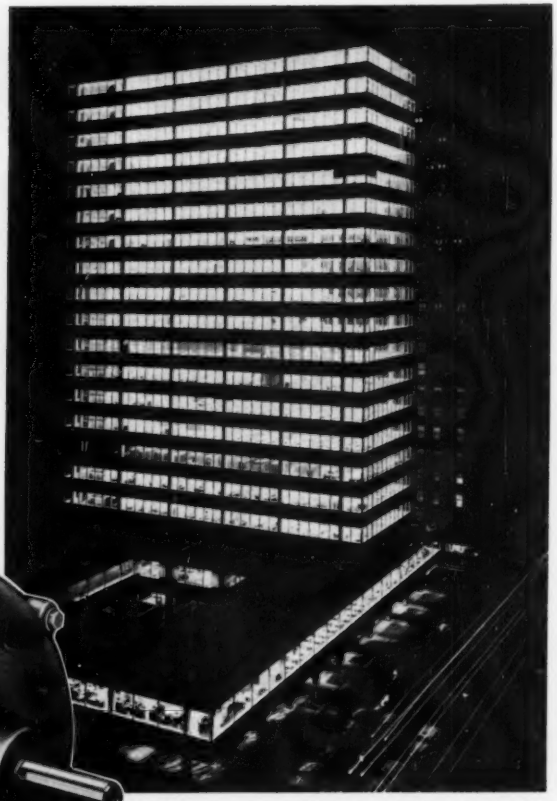
NEW MILESTONE
in office building design

LEVER HOUSE
390 Park Ave., New York

uses

ELLIOTT CROCKER-WHEELER MOTORS
for all motor needs!



Architects: Skidmore, Owings and Merrill, New York, Chicago and San Francisco.
Mechanical Engineers: Jaros, Baum and Bolles, New York.
General Contractor: George A. Fuller Company, New York.
Heating and Ventilating Contractor: Kerby Saunders, Inc., New York.

Photo© by Ezra Stoller

This all-glass-and-stainless steel building marks a new forward step in progressive architectural design of office buildings. The air conditioning is operated from three zones — north, south, and interior. Equipment capacities are sufficiently large to enable any two zones to handle the entire load should the third be temporarily shut down.

• • •

The picture at top of the page shows the effective appearance at night, and the photo below it, the attractive lobby.

You naturally look for the best of everything in the equipment of a building like Lever House. You'll find it too, in this outstandingly beautiful new office structure. Take motors for instance. Elliott Crocker-Wheeler protected-type motors are used throughout in the three-zone year-round air conditioning of Lever House. These are the same sturdy performers that serve air conditioning requirements in the new 525 William Penn Place Building, Pittsburgh . . . 100 Park Avenue Building, New York . . . Macy's Kansas City store — and numbers of other structures where air conditioning at its reliable best is a feature, and a "must" for owner, architect, builder and heating contractor.

In NEMA frames 203-505 inclusive, and larger. Vertical, NEMA C Face or D Flange mountings. All standard voltages and frequencies. Also available with brake. Descriptive Bulletin 6000-1 on request — contact your local Elliott representative or write Elliott Company, Jeannette, Pa.

ELLIOTT COMPANY
Crocker-Wheeler Division

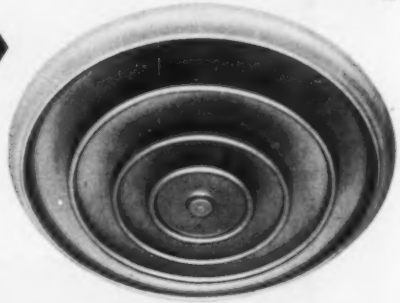
W2-19

NEW MODERN EFFICIENT

CARNES

CIRCULAR CEILING DIFFUSERS

MODEL BR



COMPARE ONLY THESE TWO FEATURES AND YOU WILL PICK A CARNES

1 ***SIMPLE TO ADJUST:***

No tools required — Finger tip control makes it easy to adjust for any desired air pattern. Simply revolve the small center plate clockwise to raise all the cones, which increases the downward deflection, and counter-clockwise to lower all the cones deflecting the air for horizontal patterns. Any desired pattern between horizontal and vertical can be easily and quickly obtained.

2 ***EASY TO INSTALL:***

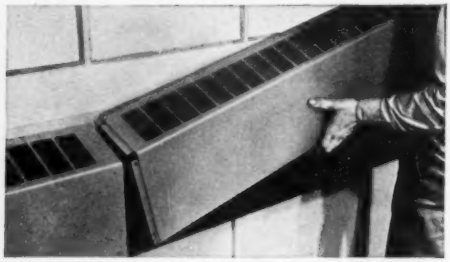
The adjustable cone assembly is made as a complete unit and to install requires only to engage to ceiling plate, and turn a few degrees clockwise. A spring loaded pin on the ceiling plate slips into a matching hole in the inner assembly, and locks it into position. This operation is done quickly and without tools, thus eliminating danger of marring or scratching finished surfaces.

W. R. CARNES CO., Verona, Wis.

How TRANE can help you

A wide variety of TRANE *Convectors provides clean, quiet heat for office buildings, schools, hospitals, homes.*

Model H Unit Heater with optional Louver Fin Diffuser.

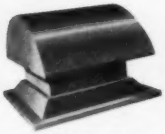


TRANE *Wall-Fin for long runs, easy assembly.*

Torridor Unit Heater—Heavy-duty blower-type.

Gas-Fired Unit Heater—Built like a boiler.

Unit Ventilator—Heat and fresh air for schools.



Powered Roof Ventilator—Efficient supply or exhaust ventilating.

Force-Flo Heater—Compact, powerful entrance unit.

MANUFACTURING ENGINEERS OF HEATING, VENTILATING

build better heating into your next job

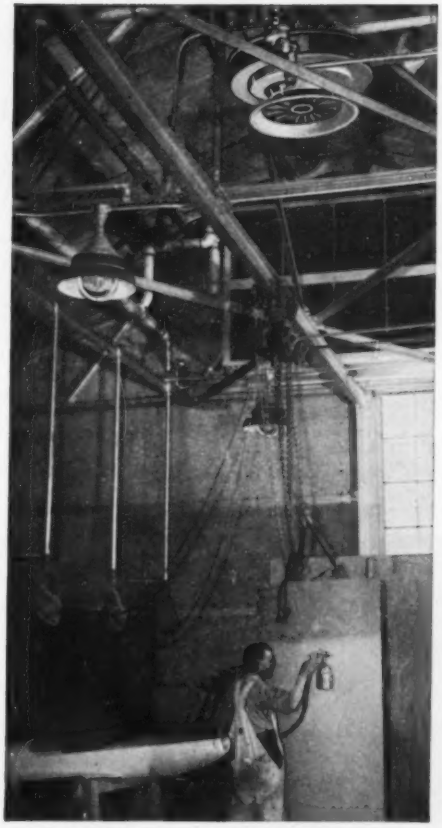
Let's say your next project is one with many *different* heating problems—long expanses of windows, hard-to-heat spots, big lobbies, drafty halls. TRANE helps you solve all these problems by building equipment to *match* the specific heating job . . . in so many models, so many sizes, that installation is easier and you get the exact results you want.

TRANE Unit Heaters simplify the special problems of factory heating. *Six different types,* to put heat wherever you want it—in remote spaces, in big production areas, in bays or craneways. Down-blow or horizontal air streams, gas, steam or hot water. Free-delivery units or duct work. Floor, wall or ceiling mounting. You can take your choice to meet your individual needs.

In TRANE Convectors, you can choose from an *unequalled range* of sizes and models. Ten distinct cabinet types: floor and wall-hung models. Sloping or flat tops, free-standing or recessed, hot water or steam. Beautifully designed to blend with modern interiors, carefully engineered to meet the exacting standards of engineers and architects.

TRANE Wall-Fin gives you a *third* answer to your heating problems. From this complete line you can specify single or tiered heating elements, hot water or steam. New additions to the line include special hanger arrangements and handsome TRANE Wall-Fin Cabinets for easy, low-cost installation.

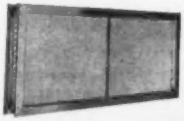
For complete information on TRANE heating equipment, see your nearest TRANE sales engineer, or write the TRANE Company at La Crosse, Wisconsin.



Projection Heater with adjustable Louver Cone.

Wall-Fin—For use when longer runs are needed.

Fans—Backwardly inclined and forward curved.



Heating Coils—All types for both steam and hot water.

Float, Bucket and Thermostatic Traps—For perfect service with TRANE heating equipment.

TRANE

THE TRANE COMPANY, LA CROSSE, WIS.
Eastern Mfg. Division, Scranton, Pa.
Trane Company of Canada, Ltd. . . . Toronto
Offices in 80 U.S. and 14 Canadian Cities

AND AIR CONDITIONING EQUIPMENT

New Texas Hospital Demonstrates Flexibility of Honeywell Customized Temperature Control

System will meet wide range of temperature control needs

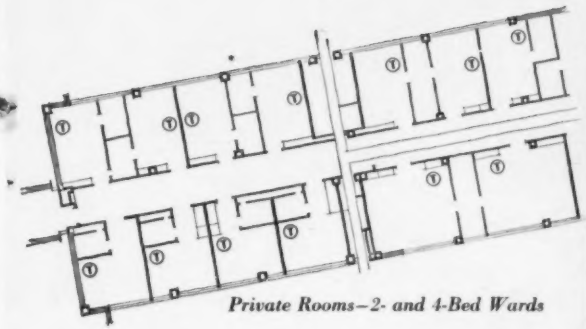
The University of Texas M. D. Anderson hospital for cancer research, now under construction in the Texas medical center at Houston, will be a truly outstanding addition to the country's medical facilities when it's completed sometime next year.

Carefully planned in every detail, this "cancer station" will contain such features as the first cobalt "bomb" in the United States for radiation treatment, color television for remote observation of operations and a betatron laboratory.

Another feature of this new building is that both heating and cooling will be controlled by Honeywell Customized Temperature Control.

The installation includes *comfort* control for patients—an individual thermostat in every patient's room. It includes operating room controls for both temperature and humidity. It includes a new electronic temperature control system to maintain photographic bath water within the exacting temperature range of plus or minus one-tenth of one degree Fahrenheit. And it includes electronic fume hood controls to remove dangerous fumes from radio isotope laboratories.

In the Anderson hospital, Honeywell Customized Temperature Control will indeed meet a wide range of temperature needs.



Private Rooms—2- and 4-Bed Wards

Notice on the floor plan that with Honeywell Customized Temperature Control each patient-room has its own individual thermostat. This means that *each* patient can be kept genuinely *comfortable* no matter what the weather outside. And it makes it possible for doctors to "prescribe" the exact temperature each patient needs to get well fast.

Plans for the Anderson hospital were developed by the following firms: MacKie & Kamrath, AIA, Architects, Houston; Schmidt, Garden & Erikson, Consulting Architects, Chicago; Lockwood & Andrews, Mechanical and Site Engineers, Houston; Walter P. Moore, Structural Engineer, Houston; Farnsworth & Chambers Co., General Contractors, Houston; Archer Plumbing Co., Mechanical Contractors, Houston.

For Comfortable, Even Temperature in New or Existing Buildings— of Any Size, Specify Honeywell Customized Temperature Control

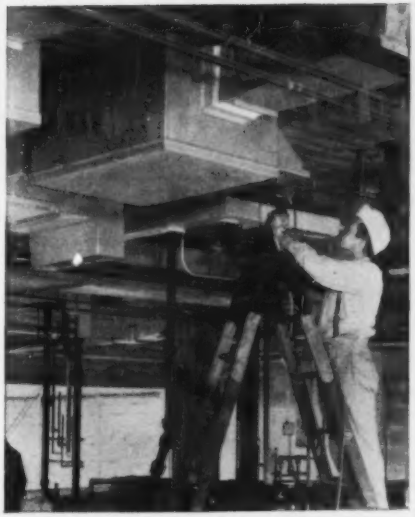
Whether it's a hospital, apartment, office, store, factory, school, garage—or any size building—new or existing, Honeywell Customized Temperature Control can help meet your clients' heating, ventilating and air conditioning problems.

Once equipped with Honeywell Customized Temperature Control, they'll have an ideal indoor "climate"—and save fuel besides.

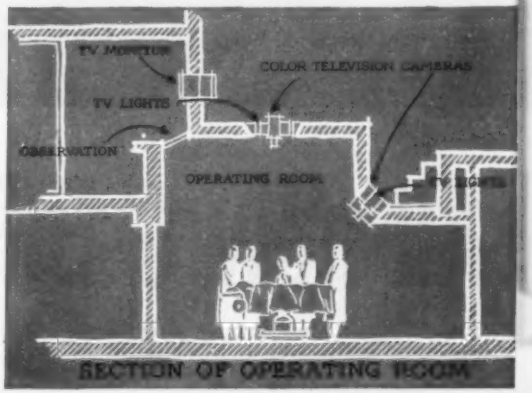
For full facts, call your local Honeywell office. There are 96 across the nation. Or mail the coupon today.

W. M. Andrews of Lockwood & Andrews, Consulting Engineers, says:

"It's an extremely flexible method of control. And that means Honeywell Customized Temperature Control can be used to meet nearly any temperature problem—in any type of building."



Honeywell Customized Temperature Control will control these air conditioning units suspended above doorways. Heating of rooms will also be thermostatically controlled. When installed *at time of construction*, system duct work can easily be concealed, can be put in at lowest cost.



SECTION OF OPERATING ROOM

Color television, as shown on the operating room cross section above, will permit over 300 students to watch surgery. Extra heat from television lights will be compensated for by sensitive Honeywell thermostats. Operating rooms will also be equipped with humidity controllers, an important feature in the Honeywell Customized Temperature Control installation.

MINNEAPOLIS
Honeywell

H HONEYWELL

First in Controls

MINNEAPOLIS-HONEYWELL REGULATOR CO.
Dept. HA-10-202, Minneapolis 8, Minnesota

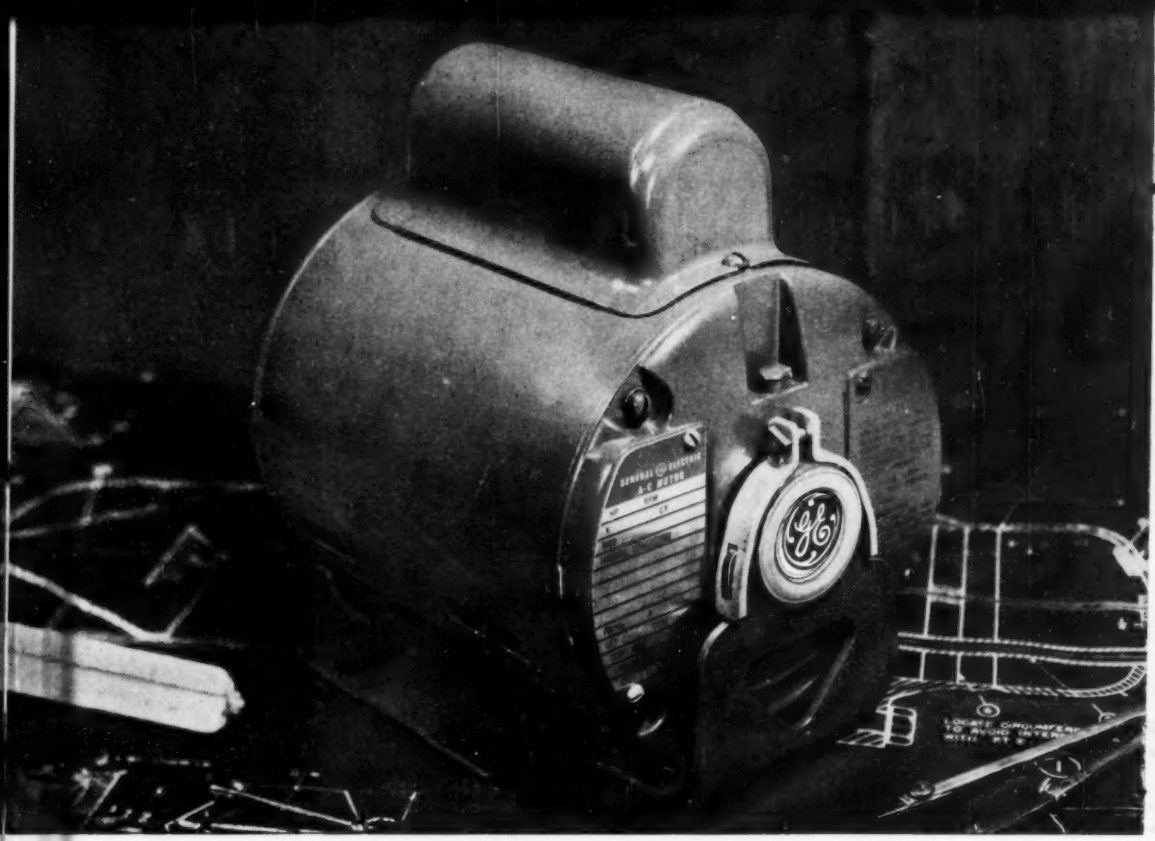
Gentlemen:
I'm interested in learning more about Honeywell Customized Temperature Control.

*Name*_____

*Firm Name*_____

*Address*_____

*City*_____ *Zone*____ *State*_____



All-new G-E Fhp Motor Has

What *does* industry want in a motor? Smaller size? Lighter weight? More versatility? Functional design? They're all here . . . in the new Form G motor! Yes, and *full NEMA performance, too!*

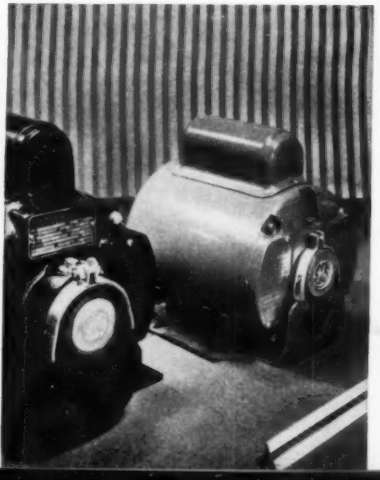
Smaller size makes product improvement possible despite critical material shortages. Lighter weight cuts shipping, installation costs, means easier handling.

Versatile, all-angle sleeve-bearings mean a general-purpose motor can replace more costly specials.

Clean-cut, functional design packs maximum power in minimum space. There's room on your product for motor improvement. Ask your G-E Sales Engineer to explain the details of the most sweeping advance in motor history . . . the new Form G fractional!

Write for bulletin GEA-5567 for a full description. *Section 700-120, General Electric Co., Schenectady 5, N. Y.*

SMALLER . . .



GENERAL ELECTRIC

ALL NEW! Shaft to shell, new motor completely redesigned, functional, no waste space.

TOUGH! New nylon insulation, braidless neoprene leads withstand insulation hazards.

QUIET! Magnetic noise cut by permanently fixed stator punchings, and new rotor design.

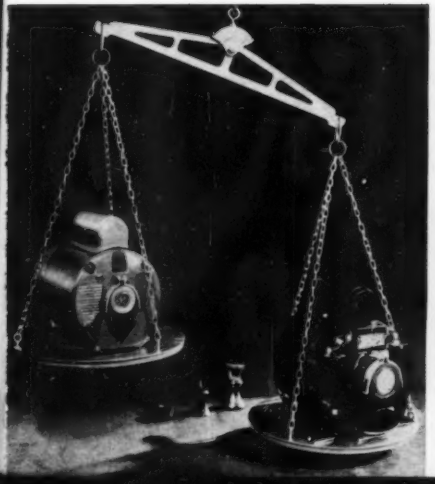
LONG LASTING! Switch, terminal board in shell, not in end-shield: prevents lead-damage.

EASY TO USE! Terminal box cover plate shows connections inside, lubrication outside.

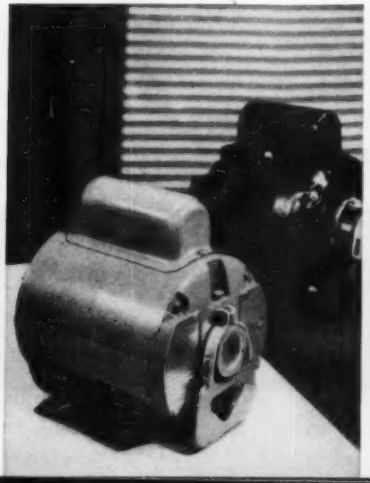
FLEXIBLE! Operates shaft up, down, any position. Cradle base allows rotation of motor.

Everything Industry Wants!

LIGHTER . . .

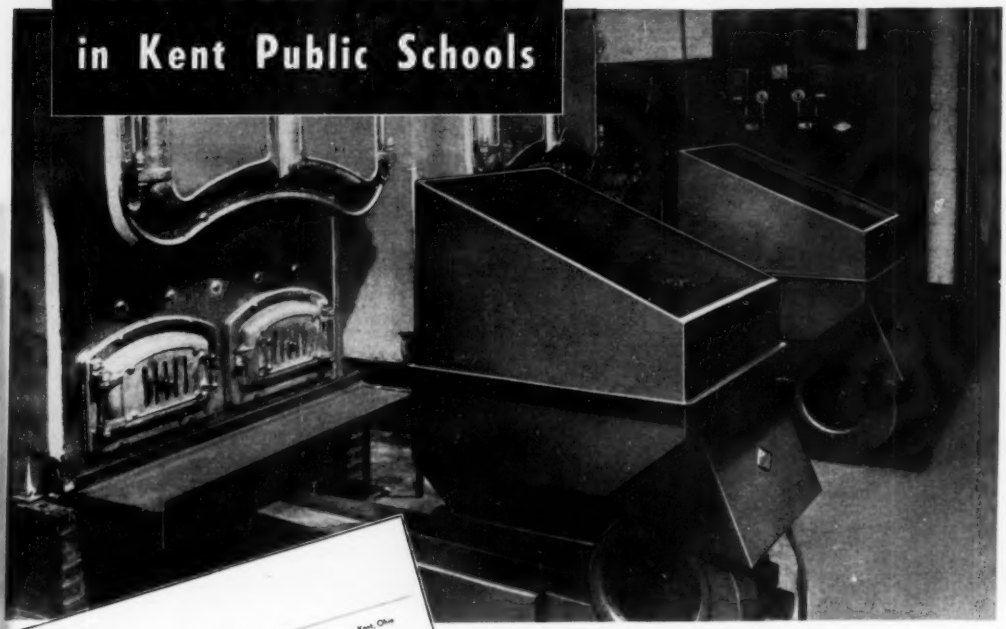


BETTER LOOKING . . .



MORE VERSATILE!

An A+ for WILL-BURT stokers in Kent Public Schools



KENT PUBLIC SCHOOLS

H. P. SMITH, Superintendent

Kent, Ohio

Will-Burt Stoker Company
Orrville
Ohio

Gentlemen:

I wish to tell you how pleased we are with our Will-Burt stoker equipment. We have had one unit in an elementary building for ten years with no trouble. Another elementary installation of three years has functioned perfectly. The dual stokers installed in our Roosevelt building in the Fall of 1950 have done well. We are proud of this installation and recommend Will-Burt to all interested in stoker equipment.

Cordially yours,

H. P. Smith
Superintendent

Since the original Will-Burt installation many years ago, Kent (Ohio) Public Schools have installed three additional Will-Burt stokers. The latest, a dual installation at Roosevelt High School, is shown above.

Why were Will-Burt stokers specified each time? Because they had proved their economy . . . trouble-free operation . . . and year-in year-out dependable performance. Yes, if stokers were rated like students, there'd be a big A+ for Will-Burt at the Kent Public Schools.

Engineers and contractors have found it pays to specify Will-Burt. More *good* words from the customer — paving the way to future jobs.

Write today for facts on the Will-Burt line.

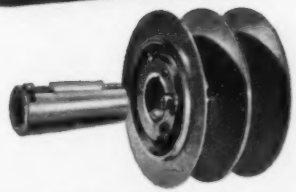
WILL-BURT

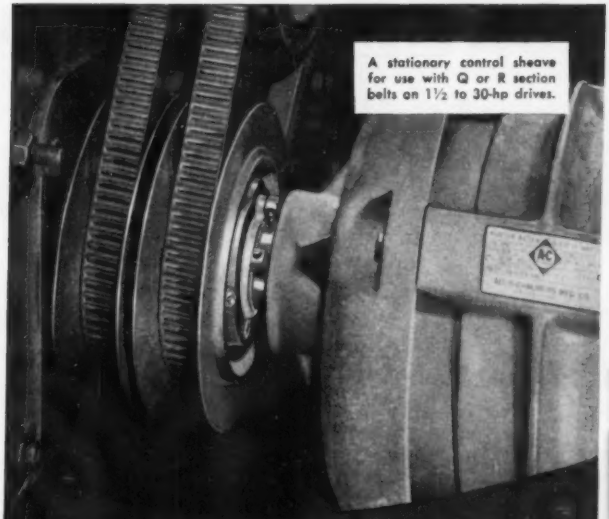
THE WILL-BURT COMPANY

DEPARTMENT H ORRVILLE, OHIO

STOKERS • RESIDENTIAL BOILERS • OIL AND GAS CONVERSION BURNERS

TEXROPE





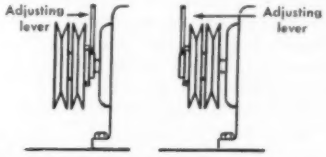
NOW!
Wide Range has 3 New Advantages

1 Magic-Grip Mounting

The widely used *Magic-Grip* tapered bushing is now supplied with the Wide Range *Vari-Pitch* sheave, making it the fastest mounting sheave of its type on the market. Turning only one screw makes or breaks the vise-like grip of sheave bushing on motor shaft.

2 Fast Adjustment

To change sheave diameter — thereby changing speed — simply turn a single adjusting screw, *using a lever rod* that slips through a hole in the head of the screw. No more fumbling with screw drivers. Adjustment is fast and accurate.



3 Adjusts From Either Side

Sheave can be mounted on motor shaft so adjusting screw is either toward or away from motor bearing, as indicated above. This feature is especially important in installations where space for adjustment is limited. It's the only sheave of its type with this feature.

GET COMPLETE DATA FROM YOUR NEARBY ALLIS-CHALMERS DISTRIBUTOR OR DISTRICT OFFICE, OR SEND COUPON.

ALLIS-CHALMERS
MILWAUKEE 1, WIS.

Send me complete specifications and engineering data on the new Wide Range *Vari-Pitch* sheave . . . 20S7811.

Name.....

Title.....

Company.....

Street.....

City.....State.....

A-3841

Texrope, Vari-Pitch and Magic-Grip are Allis-Chalmers trademarks.

ALLIS-CHALMERS

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The U. S. Steel Supply team that gives you

personalized service

These people *specialize* in good steel service!

GOOD STEEL SERVICE is much more than a one-man job . . . it requires teamwork between specialists. Each of our warehouses has such a team ready to go to work to give you fast, trouble-free service.

Your U. S. Steel Supply salesman will put the members of this team to work for you. Call him for steel, tools, equipment, machinery, advice on the selection of the right type of steel, or assistance on production techniques with special steels. United States Steel Supply is a "one call" source of steel supply service . . . one call to our salesman puts an expert team to work to see that you get what you want—where you want it—when you want it.

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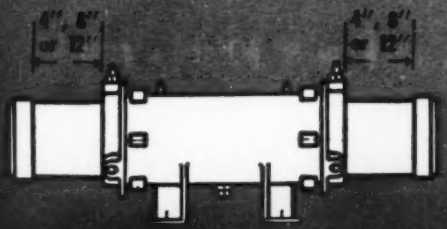
UNITED STATES STEEL

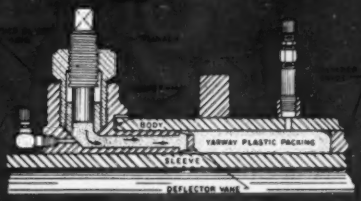
YOU NEED FEWER JOINTS



With Yarway Gun-Pakt slip-type expansion joints you need fewer joints than with other types, because each sliding sleeve has a traverse of 4", 8" or 12" ... maximum expansion being 24" for a double-end joint.

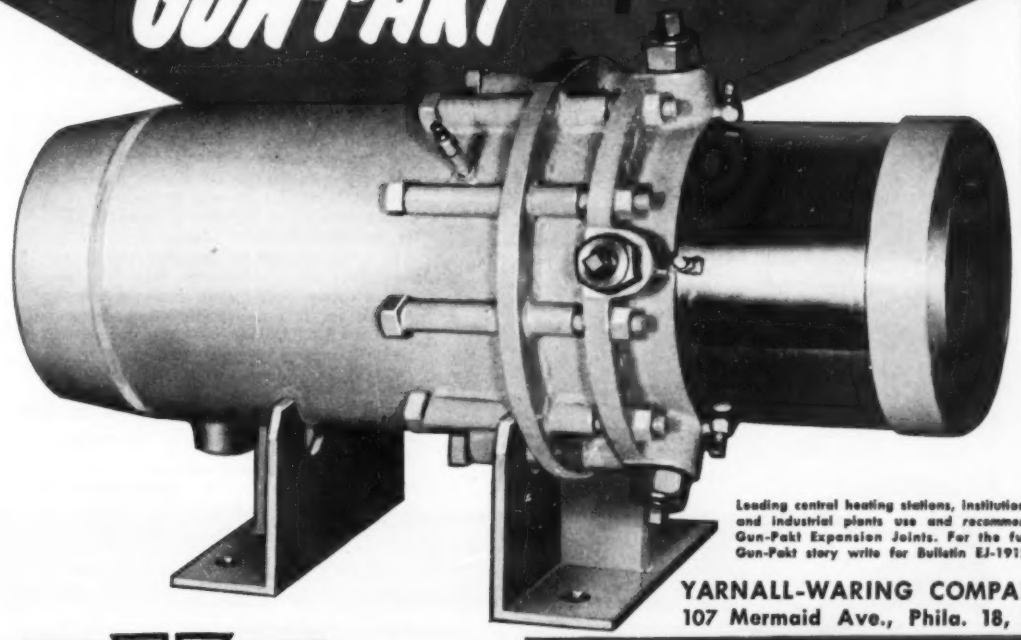
For example, one single-end Yarway Gun-Pakt joint with an 8" traverse is all that is needed for a 200 ft. run of steel pipe carrying saturated steam at 250 psi.

AND LESS MAINTENANCE



No need for shutdowns. Yarway Gun-Pakt Joints are serviced under full steam pressure. Just insert a plug of Yarway plastic packing, paint a wrench and the job is done. Maintenance and production manhours are saved!

with GUN-PAKT expansion joints

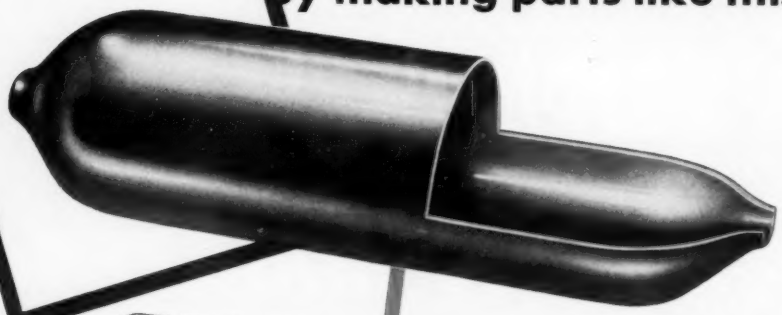


Leading central heating stations, institutions and industrial plants use and recommend Gun-Pakt Expansion Joints. For the full Gun-Pakt story write for Bulletin EJ-1912.

YARNALL-WARING COMPANY
107 Mermaid Ave., Phila. 18, Pa.

YARWAY GUN-PAKT EXPANSION JOINT

Much Time and Material can be saved by making parts like this



This complete form was produced in ONE simple, fast operation by spinning the ends of a Wolverine seamless copper tube.

TWO OR MORE operations are required to produce a similar form by any other method.

..with WOLVERINE'S Spun End Process*

Whether the part is made by assembling two horizontal halves which were stamped out from a flat sheet, or whether it necessitates the stamping or casting of caps to put on each end of a plain tube, there is still the additional job of soldering or brazing to complete the unit.

You can eliminate many of these operations through the use of our Spun End Process. You can save time and material, and also reduce tool costs.

An additional advantage lies in the fact that the resulting part is all one piece—therefore has no joints to cause leaks.

The tools to produce tubular forms such as this can be made, in some instances, for as little as one-tenth the cost of those required for the old method.

If your equipment requires component parts that are tubular, look into this Spun End Process and learn about the many possibilities it presents for you. Ask our Customer Engineering Service to discuss this unique process with your engineers.

Wolverine Trufin and the Wolverine Spun End Process available in Canada through the Unifin Tube Co., London, Ont.

*A PATENTED PROCESS RE. 22465

WOLVERINE TUBE DIVISION
Calumet & Hecla Consolidated Copper Company
INCORPORATED
Manufacturers of tubing exclusively
1419 CENTRAL AVENUE • DETROIT 9, MICHIGAN

Wolverine Mill Depots:
DETROIT, MICH. • DECATUR, ALA. • HOUSTON, TEXAS • LOS ANGELES, CALIF.
LONG ISLAND CITY, N. Y. • PHILADELPHIA, PA. • PROVIDENCE, R. I. • ST. LOUIS, MO.

Sales Offices in Principal Cities

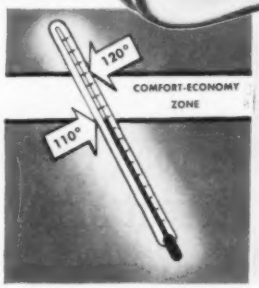
REASONS WHY

engineers rate Modine the standard of excellence

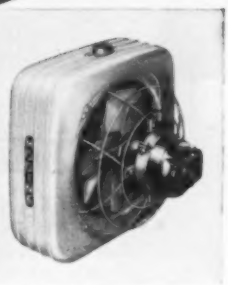
Modine steam and hot water units are built in Horizontal (illustrated), Vertical Delivery and Power-Throw models.

Four of the many reasons why Modine enjoys this quality reputation

YOU have to look beyond Btu capacity to get the most from your unit heating dollars. Modine balanced design gives you the correct combination of outlet air temperatures, volume and velocities. Your assurance of perfect heating comfort plus lower fuel costs. See the Modine representative listed in your classified phone book, or write Modine Manufacturing Co., 1509 DeKoven Avenue, Racine, Wisconsin.



Discharge air temperatures of 110°-120° F. are correctly related to air velocities. Your assurance of perfect heating comfort, lower fuel costs.



Direct-from-pipe suspension is safe and economical, with no hanger-rods. Heated air stream may be easily redirected over full 360° range.

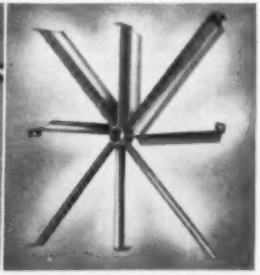
WHEREVER GAS IS AVAILABLE, MODINE GAS UNIT HEATERS GIVE YOU LOW-COST HEATING!

Modine is the only gas-fired unit heater with both *stainless steel* heat exchanger and burner.

Get a recommendation based on your needs. Write for facts on steam and hot water (Bulletin 149-A) and gas-fired (Bulletin 651) unit heaters.

Modine UNIT HEATERS

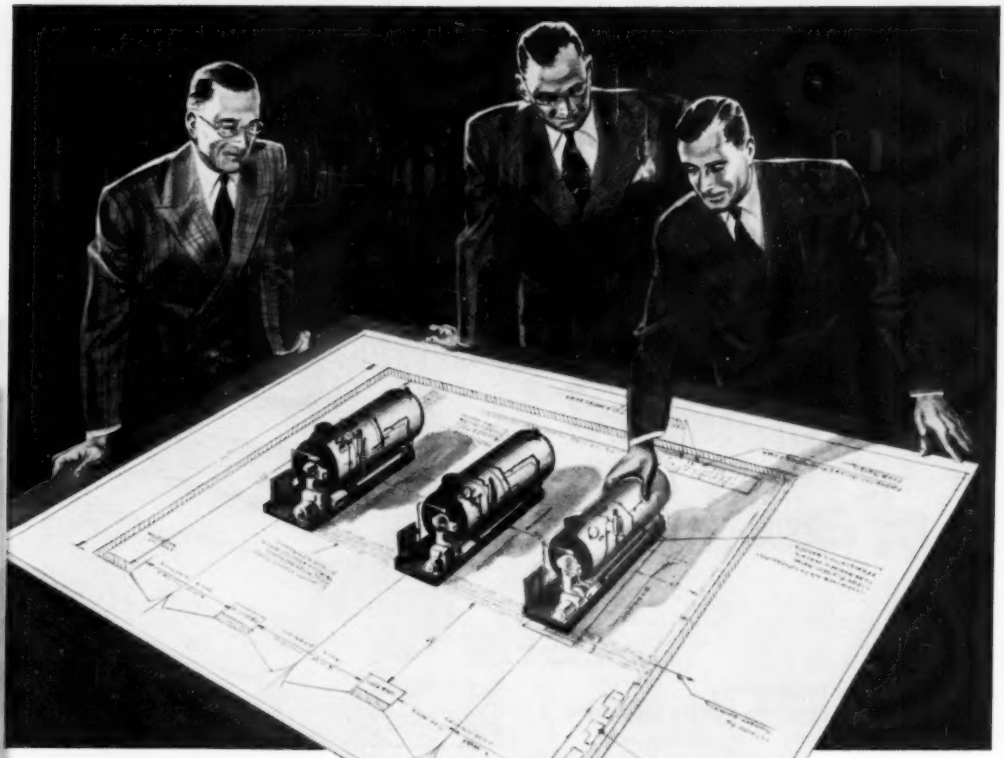
Built-in velocity generator effectively steps up heat throw. This assures positive heat penetration of the cold air strata that is near the floor.



Sturdy, steel integral fan guard offers safety from exposed fan — serves as resilient, vibration-absorbing mounting for motor.

U-1163

Plan Your Boiler Installation this Way..



...to Balance Load Factor with Low Investment
...to Meet Present Needs and Future Expansion...

CLEAVER-BROOKS self-contained steam boilers are the answer to both present and future steam needs. You can install Cleaver-Brooks boilers in units to fit your present steam capacity requirements . . . keeping your investment at a minimum and your boiler efficiency at a maximum. Here's how it works . . .

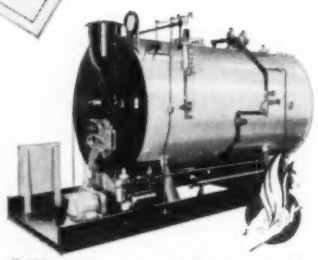
Your initial Cleaver-Brooks boiler installation is made in the size or capacity to fit your present steam load — this assures full use now at top efficiency and low capital investment.

As increased steam needs arise, additional Cleaver-Brooks boilers can be added to keep pace with your expanded requirements.

With this flexible program, you have the greatest return from your boiler investment — minimum original cost and lowest operating cost. Your boilers are always operating at maximum efficiency (80%) over the entire working range (30 to 100%).

Cleaver-Brooks self-contained boilers are ideal for multiple installations because of their compactness, low headroom requirements, fast installation, automatic operation, range of sizes. Available in standard models—15 to 500 hp.; 15 to 250 psi; gas, oil or combination gas and oil fired units.

Get all the story — write today for latest catalog.



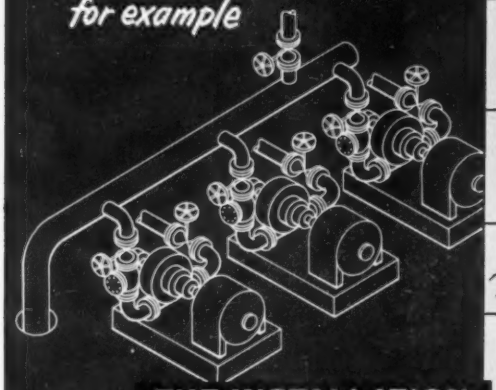
Cleaver-Brooks

Dept. L-312 E. Keefe Ave., Milwaukee 12, Wis., U.S.A.
Cable Address: Clebro-Milwaukeewis

Builders of Equipment for the Generation and Utilization of Heat • Steam Boilers • Oil and Bitumen Tank-Car Heaters • Distillation Equipment • Oil and Gas-Fired Conversion Burners

Can You Trust Your Checks to Hold Like This?

. . . on Water Pumps, for example



THE INSTALLATION

Crane Iron Body Swing Check Valves in 8-inch vertical lines on discharge side of water pumps supplying a large eastern paper mill.

VALVE SERVICE RATINGS

SUITABILITY:	Working smoothly - no complaints
FEATURES:	O.K. for either horizontal or upward flow
MAINTENANCE COST:	None - no maintenance needed to date
SERVICE LIFE:	Now better than other checks used
OPERATING RESULTS:	No water or head loss
PRICE:	In line with other makes
AVAILABILITY:	Stock item - Crane product

THE HISTORY

The mill depends on these pumps for all water. Loss of head at the pumps would create a serious problem. The mill could take no such risks. Regularly, the check valves on pumps were replaced, but only to be found leaking between pumping cycles, a few months later.

It's now more than a year since the change-over was made to Crane Check Valves. There's been no loss of water, no maintenance or replacement of any checks on the pumps. That was proof enough for the mill, that Crane Quality means better valves —greater dependability and bigger value. As a result, 3 more of these checks were installed on a separate battery of suction pumps.

THE VALVE

Crane No. 373, 125-Pound Iron Body Swing Check Valves, brass trimmed. The long life and high seating efficiency of these checks, in 2 to 8-in. sizes, is in large part due to the Crane patented flexible disc-hinge design. Double spring mounting eliminates lost motion between parts, yet permits true, full contact of disc and seat at every closure. Also serves to absorb the shock of seating under back-flow pressure. See your Crane Catalog or Crane Representative for full details.

The Complete Crane Line Meets All Valve Needs. That's Why

More Crane Valves Are Used Than Any Other Make!

CRANE VALVES

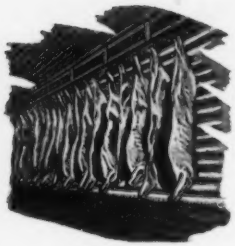
CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois

Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING

UNSURPASSED

in the Refrigeration Industry



W-S FORGED STEEL FITTINGS

Screw-End and Socket-Weld Types

Since Watson-Stillman engineers first developed their special line of forged steel fittings to meet the service conditions of the Refrigeration Industry, the W-S double-diamond trade-marked fitting has been identified with longer, more dependable life and lowest per-year cost in all phases of the industry's operations.

Precision-machined from solid drop-forged steel bodies, Watson-Stillman fittings are much less subject to unscheduled outages than fittings made from other materials or by other methods of fabrication. Being stronger, they are much smaller and lighter . . . bringing economies in weight and space all the way down the line. Their denser, tougher metallic structure is more resistant to corrosion, vibration, shock, and all types of stresses—including internal pressure and creep—than other types.

Yes, there are many reasons why W-S double-diamond fittings are preferred by *all* industries. Want more information? See your Watson-Stillman distributor or write direct.

• Stronger • Smaller • Lighter • Tighter
• More Uniform • Lower Service Cost

SOLD THROUGH LEADING DISTRIBUTORS . . . EVERYWHERE

9-M-4

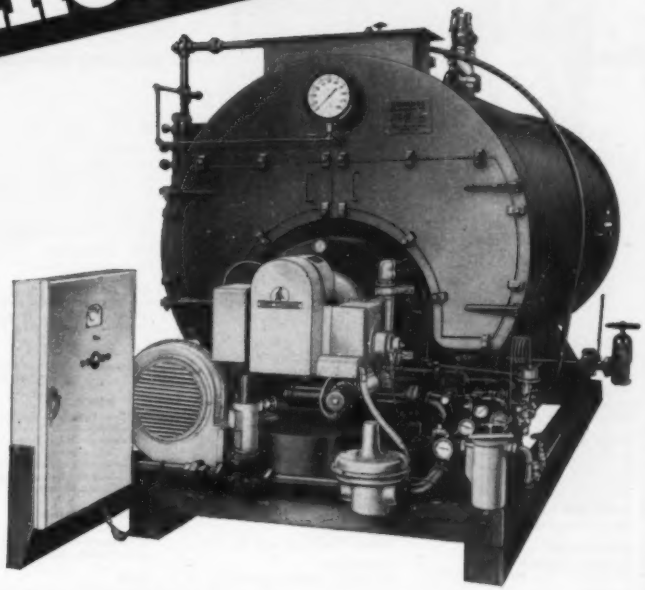
WATSON-STILLMAN
ESTABLISHED 1848

DISTRIBUTOR PRODUCTS DIVISION
ROSELLE, NEW JERSEY

Designers and Manufacturers of Forged Steel Fittings, Hand Pumps, Jacks, Wire Rope Shears, Pipe Benders and Hydraulic Equipment

KEWANEE and IRON FIREMAN

- *For oil, for gas, or oil and gas firing*
- *For every commercial and industrial application*



Jointly announce a NEW boiler-burner UNIT

Two outstanding companies in their respective fields—Iron Fireman and Kewanee—have combined their engineering talents and their long experience in designing and producing this unique new boiler-burner unit.

Every part has been skillfully engineered for balanced operation to give users what they want; efficient utilization of fuels, with resulting low-cost steam; and fully automatic, dependable performance.

The burner, including all controls, built-in forced draft fan and oil pre-heating system, is completely assembled, wired, tested and shipped to the installation site from Iron Fireman. The boiler, completely assembled with all of its essential elements, is shipped from Kewanee. Matching connections are provided for quick, easy installation.

Available for high pressure steam in sizes with outputs ranging from 52 to 456 h.p., 125 and 150 lb. working pressure, and also from 5470 EDR 15 lb. steam or 30 lb. water. These units may be automatically fired with No. 6 or lighter fuel oils, gas (either high pressure or as low as 2 oz.) or a combination of both fuels.

Send for this 14-page catalog

This catalog, produced in full color, gives COMPLETE information on all sizes and models, including *detailed specifications.*

Use coupon or write

MAIL to KEWANEE or IRON FIREMAN

Name_____

Company_____

Address_____

IRON FIREMAN MFG. CO.
3106 West 106 Street, Cleveland 11, Ohio

KEWANEE-ROSS CORPORATION
106 Franklin Street, Kewanee, Illinois

Fast Motor Service Wherever You Are

"Certified"

Factory approved motor service in every industrial area from 97 Allis-Chalmers Certified Service Shops.

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Montgomery—Standard Electric

ARIZONA
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CALIFORNIA
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Oakland—T. L. Rosenberg Co.
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COLORADO
Denver—Baker Electric Company

CONNECTICUT
Hartford—Charles H. Leppert
Waterbury—Elec. Motor Repair Co.

FLORIDA
Jacksonville—Turner Electric Works
Miami—Peninsular Armature Works
Tampa—Tampa Armature Works

GEORGIA
Albany—Georgia Electric Co.
Atlanta—Bearden-Thompson Elec. Co.
Columbus—Smith-Gray Electric Co.

ILLINOIS
Chicago—Chicago Electric Co.
Marion—Giles Armature & Elec. Wks.
Mt. Vernon—Dowzer Electric

INDIANA
Indianapolis—Scherer Electric Co.
Evansville—Evansville Elec. & Mfg. Co.

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Of course, Allis-Chalmers Certified Service Shops give good service on any electrical equipment, of any make. Tear out this ad and save it, or write the name of the A-C Certified Service Shop nearest you in your address book. Allis-Chalmers, Milwaukee 1, Wisconsin. A-3864

Texrope and *Vari-Pitch* are Allis-Chalmers trademarks.

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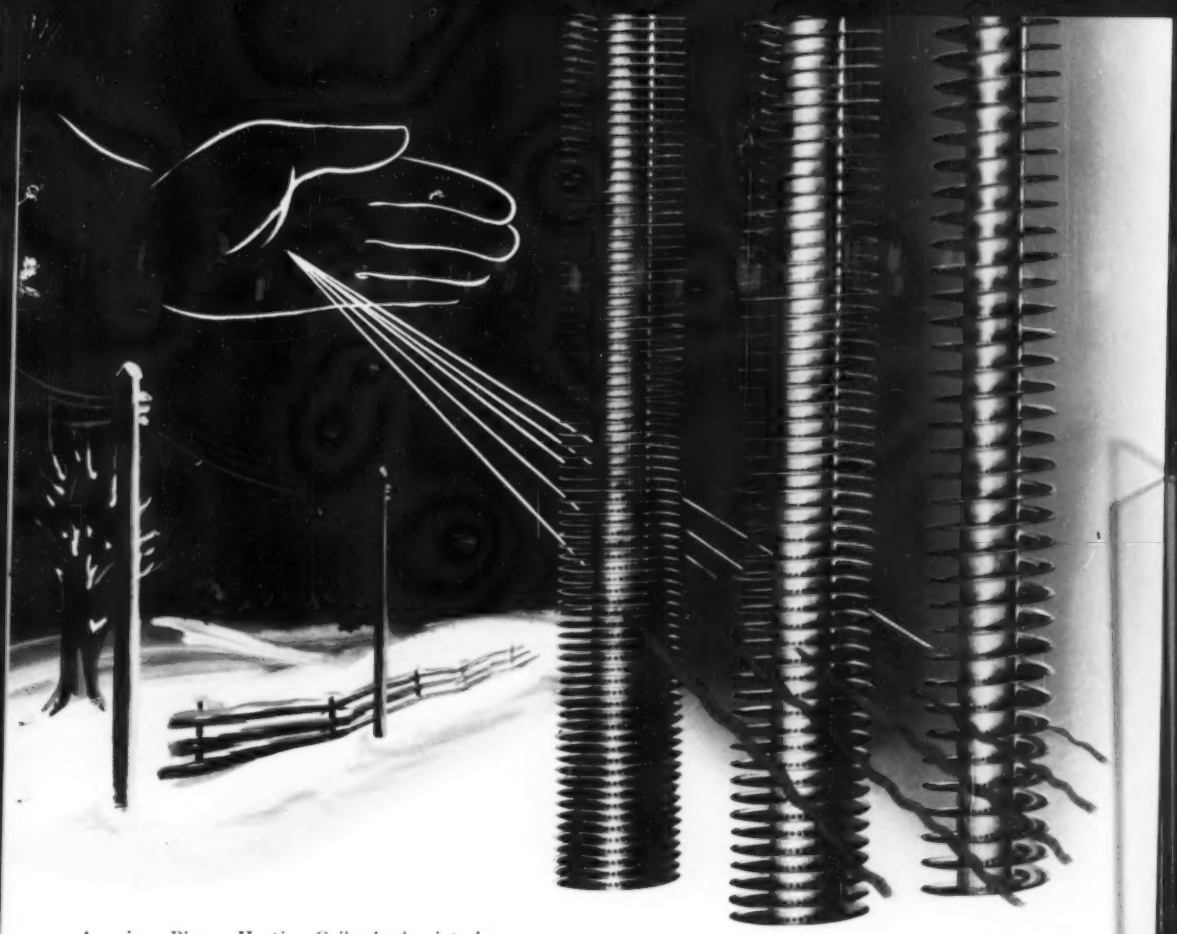
CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.

TEXROPE — Belts in all sizes and sections, standard and *Vari-Pitch* sheaves, speed changers.

PUMPS — Integral types from ¾ in. to 72 in. discharge and up.



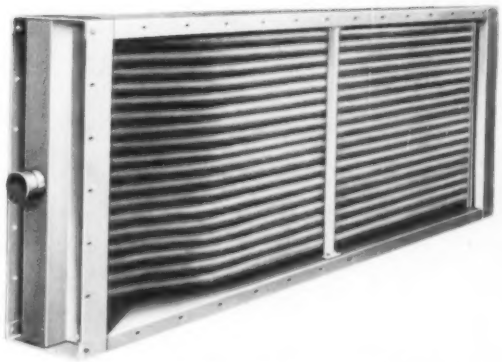
American Blower Heating Coils check winter's icy hand.

They're quality-built. All tubing is helically wound with copper or aluminum fins in three standard spacings (see above). Coil casings are made of heavy galvanized steel; headers are of die-formed steel.

Whether you need coils for blast heating, zone reheating or whether you want return bend coils or coils for modulated steam control — you'll find the size and type that best fits your needs in the American Blower line. Write for further data.

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

Division of American Radiator & Standard Sanitary corporation



Type S Steam Coil for normal blast heating. Tested and guaranteed for operation with steam up to 200 lbs. gauge pressure and 450°F temperature. Die-formed tube support protects tubes. Write for Bulletin B-1218.

AMERICAN BLOWER

YOUR BEST BUY IN AIR HANDLING EQUIPMENT

Serving home and industry

AMERICAN-STANDARD • AMERICAN BLOWER • ACME CABINETS • CHURCH SEATS • DETROIT LUBRICATOR • KEWANEE BOILERS • ROSS HEATER • TONAWANDA IRON

Machine Against Muscle

THE STORY OF WHY A FAMOUS COMPANY SEES FIT TO TAKE A NEW NAME

In 1924 the dream of a man named Joseph W. Sullivan was realized in a revolutionary new tool that was to take the industrial world by storm. The portable power saw was born and a young company was off to a flying start.

Inevitably, the success of this new power tool attracted imitators, brought others to the field. In spite of this, Skilsaw, Inc., maintained a leadership which continues to keep it first in the field.

With this remarkable growth came stronger and stronger demand from *all* industry for *other* kinds of power tools built with SKIL Quality, *other* ways to replace muscle with machine and do jobs better, with less work in less time. Skilsaw, Inc., has answered this demand—now offers more than 160 different models of portable power tools, each one an example of the finest engineering and quality in the field—SKIL Quality!

So it is with justifiable pride that we now alter a corporate name we have in simple fact outgrown. Hereafter, the company long known as Skilsaw, Inc., will be known as SKIL Corporation, the name to be remembered in the manufacture, sale and service of portable power tools.

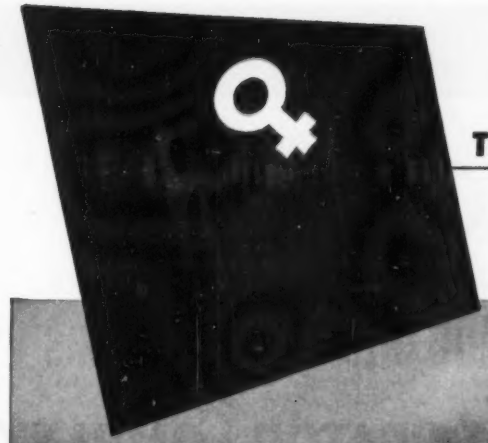
SKIL Corporation

formerly SKILSAW, Inc.

5033 ELSTON AVENUE, CHICAGO 30, ILLINOIS

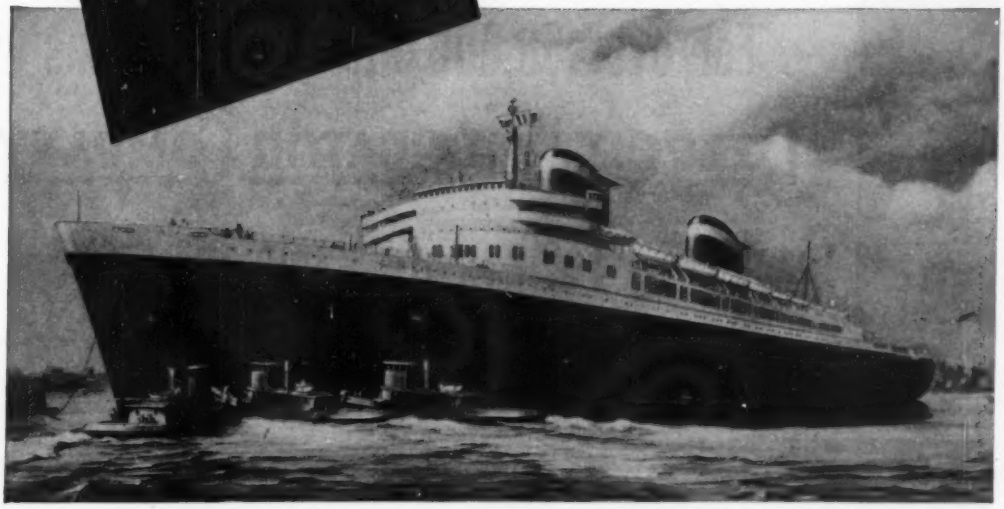
SKIL PORTABLE TOOLS

26 DIFFERENT TOOLS BESIDES SAWS...IN OVER 160 MODELS



THE *Traditional*

MARITIME METAL



Since the earliest days of the Viking ships, copper and copper base alloys have been a traditional and vital metal in all ship construction to withstand the highly corrosive conditions of the sea. Today more than ever, copper is used extensively throughout giant ocean liners like the new S.S. UNITED STATES—51,500 ton luxury ship of the United States Lines. This new ship is the largest fully air conditioned ship in the world—and copper, of course, played an important role in her vast air conditioning system.

Wherever the long life and dependability of copper are required you'll find HUSSEY Copper well represented.

HUSSEY COPPER *and Brass*

C. G. HUSSEY & COMPANY
(Division of Copper Range Co.)
ROLLING MILLS AND GENERAL OFFICES
PITTSBURGH 19, PA.

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1877 75 YEARS OF PROGRESS 1952

For over 50,000,000 good reasons

DETROIT LUBRICATOR COMPANY

revises its name to

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DETROIT-Controls CORPORATION

ESTABLISHED AS DETROIT LUBRICATOR COMPANY IN 1877

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REPRESENTATIVES IN PRINCIPAL CITIES • Canadian Representatives in Montreal, Toronto, Winnipeg—RAILWAY & ENGINEERING SPECIALTIES, LTD.

PERHAPS you're wondering why a company in its 75th year of business would change its name. Quite frankly, on checking the record in this our diamond anniversary year, we decided purely and simply that we had outgrown the name Detroit Lubricator Company.

During the course of 75 years of constant business growth and expansion, DETROIT has progressed from leadership in one industry into leadership in still another industry—that of building the finest automatic controls for heating, refrigeration, air conditioning, engine protection, home appliances and industrial uses. Over 50,000,000 of these superior DETROIT controls have been produced to serve home and industry—and that means a lot of satisfied customers—a lot of mighty *good* reasons why we feel we have earned the right to our new name... Detroit Controls Corporation.

We sincerely hope that as Detroit Controls Corporation we will continue to enjoy the splendid cooperation and support you have always given Detroit Lubricator Company in the past.

To this end, our people, our policies and our production remain the same—pledged always to highest quality to bring you the very finest automatic controls obtainable.

trols CORPORATION

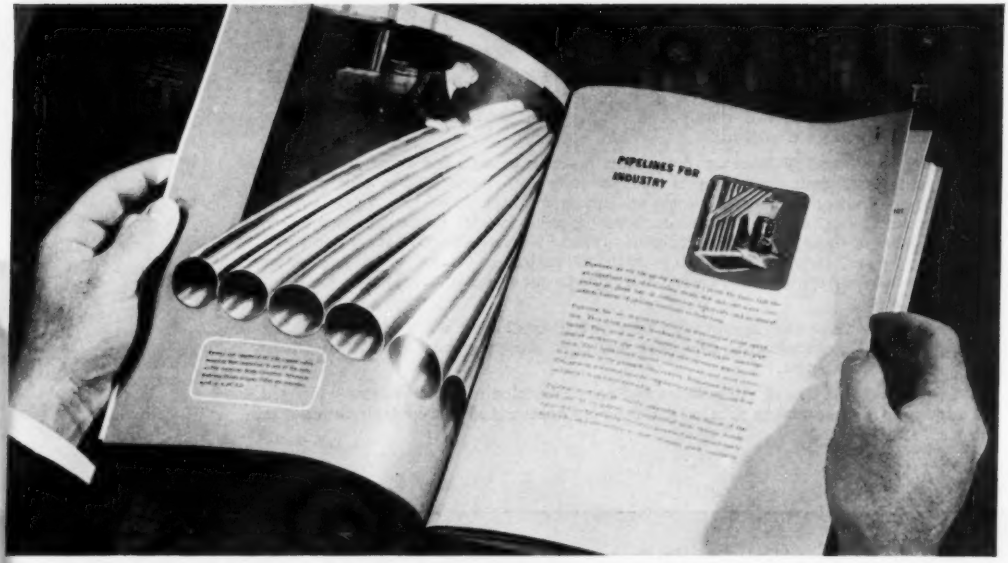
DETROIT CONTROLS

AUTOMATIC CONTROLS *for*

REFRIGERATION AIR CONDITIONING DOMESTIC HEATING
AVIATION TRANSPORTATION HOME APPLIANCES INDUSTRIAL USES

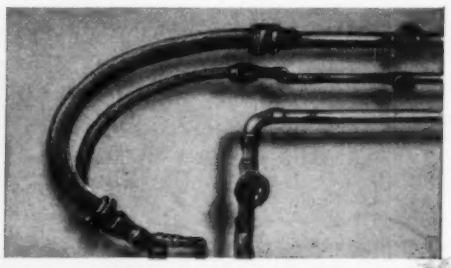
Serving home and industry – AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS • DETROIT CONTROLS • KEWANEE BOILERS • ROSS HEATER • TONAWANDA IRON

Here's where you can get the FACTS about COPPER tubes for industry:



1. WELL-ILLUSTRATED BOOKLET, entitled "ANACONDA Copper Tubes for Industrial Applications," is yours for the asking. It contains useful information on copper tubes, their applications, advantages, installation, fittings, and assembly. Numerous reference tables are handy for both user and installer. You will find the answer to many of your questions about flow and friction losses, B.T.U. capacities, bursting pressures, etc. Use the coupon below to get your copy of Booklet C-24.

2. CONVENIENCE means economy. Here, for instance, confined quarters offers no real obstacle to installing ANACONDA Copper Tubes. Note carefully the slight bends—possible with copper. Copper also means low friction losses and as much as 15% greater flow velocity. You'll find these useful facts contained in the pages of Booklet C-24.



3. INTERESTING WRINKLE. Expansion of pipe lines often presents a problem. Try this solution. On long runs American Flexible Metal Hose Connections allow ample lateral movement. Many wholesalers can supply you with these useful connectors. For reliable service on ANACONDA Copper and Copper Alloys—why not consult your ANACONDA Distributor.

5227

The American Brass Company
Waterbury 20, Connecticut
(In Canada: Anaconda American Brass Ltd., New Toronto, Ont.)

Gentlemen: I'd like to bring my files up-to-date with your informative Booklet C-24, "ANACONDA Copper Tubes for Industrial Applications." Please rush me a copy.

NAME..... FIRM NAME.....

ADDRESS..... STREET.....

CITY..... ZONE.... STATE.....

modern piping calls for
ANACONDA®
copper tubes

McQuay

DOWN FLOW
UNIT HEATERS

...the answer on how to beat wasted ceiling heat!

Save the hot air ordinarily wasted in buildings with high ceilings with McQuay Down Flow Unit Heaters. These vertical unit heaters have the famous Ripple-Fin Coils—providing peak heating efficiency and will lower your heating costs by circulating evenly and gently this normally wasted stratified air.

There are 22 Down Flow Units available to meet your exact requirements. Capacity range from 25,400 to 500,000 Btu per hour. Four styles of directional air diffusers are available to provide any desired air distribution.

Consult the McQuay representative in your city, or write McQuay, Inc., 1601 Broadway St. N.E., Minneapolis 13, Minnesota.

HORIZONTAL UNIT HEATERS

These unit heaters are offered for normal applications where horizontal air flow is desired. In 24 sizes with capacities ranging from 20,300 to 360,000 Btu per hour.

BLOWER TYPE UNIT HEATERS

For effective heat distribution over large open areas. Available in 8 sizes . . . in suspended and floor models, with one and two row coils; capacities from 20,600 to 1,600,000 Btu per hour.

ONLY McQuay OFFERS ALL THESE PROVED AND PREFERRED FEATURES:

- Ripple-Fin Construction
- Distinctive Styling
- Non-Ferrous Coil
- Steam or Water
- Certified Ratings
- Maximum Air Throw
- Quiet Operation
- Efficient Performance
- Long Life

REFRIGERATION
AIR CONDITIONING
HEATING

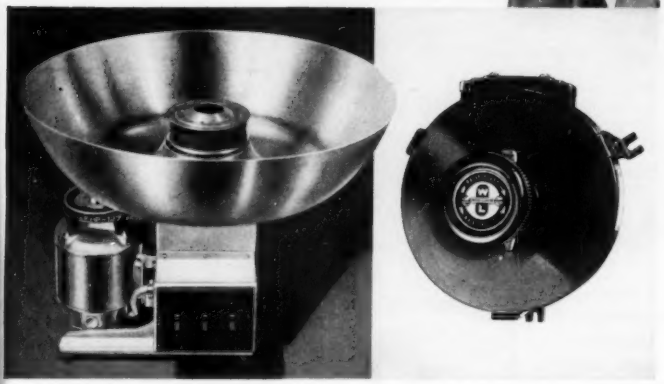
MAKE THE SEASONS COME TO YOU

McQuay INC.

The Electric Candy Floss Machine Co.

"A pink cotton candy machine rheostat must provide exact temperature control"

says John G. Pettyjohn,
John G. Pettyjohn Company, Knoxville, Tennessee,
representative for Ward Leonard Electric Company.



Spinning sugar into fine, fluffy floss for pink cotton candy requires precise heat control. Unless a high degree of heat is closely controlled, candy becomes too thick or too thin. Also, since these machines are used at circuses, traveling carnivals, resorts, and similar places, machines must be able to compensate for variance in voltage and surrounding temperature, depending upon the location.

The Electric Candy Floss Machine Company, Nashville, Tenn., uses Ward Leonard VITROHM plate rheostats in the heater circuits on the spinner heads of their new super deluxe candy floss machines for two reasons: (1) VITROHM rheostats are the only rheostats they have found that would stand up and give good service, (2) they are able to get a much better grade of candy.

Ward Leonard rheostats are available in several multiples of resistance values to meet various operating conditions. Special purpose rheostats requiring non-standard values and tapers can also be supplied.

Ward Leonard's engineering department is always ready to work with you to design or recommend the most economical rheostat for your particular application. Write for Ward Leonard Rheostat Bulletin 60A.

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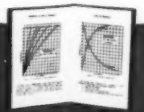
MOUNT VERNON, NEW YORK

RHEOSTATS · RELAYS · MOTOR CONTROLS · CHROMASTER

Result-Engineered Controls Since 1892

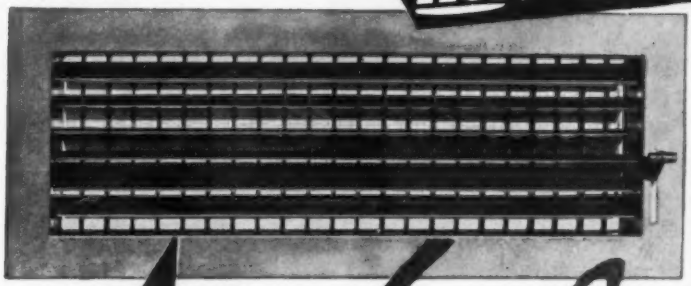


Ward Leonard's complete engineering textbook, "Handbook of Power Resistors," $3. per copy.

MAKES ANY AIR CONDITIONING SYSTEM A BETTER AIR CONDITIONING SYSTEM

Yet It COSTS LESS.....

● *Illustrated below—* #276 4-way multi-shutter register . . . features front louvers and rear damper blades parallel to long dimension . . . second row louvers parallel to short dimension.



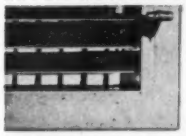
Air Foil

4-WAY MULTI-SHUTTER REGISTER

SOLID-SECTION AIRFOIL LOUVER

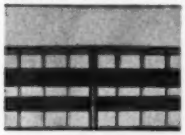
● Louver knifes air in wind tunnel tests. Turbulence has been almost eliminated giving noiseless control of air.

LEVER CONTROL



● Inconspicuous lever in face of frame controls dampers for complete shut-off.

EXTRA-STRENGTH FRAME . . . . .



● New, exclusive Titus concealed support eliminates unsightly mullions and butted construction.

The smartly designed #276 combines *4-way #270 grille* with the *multi-shutter damper* to assure maximum directional control with positive volume control and shut-off. Damper blades interlock for complete shut-off.

The two front sets of louvers are individually adjustable with blades on ¾ inch centers.

Dampers are controlled from face of grille by inconspicuous lever. Removable lever furnished at no extra cost.

EXTRA STRENGTH—LONGER LIFE

Sound, inspired know-how engineering gives the #276 superb simplicity of design with no unnecessary parts—no clumsy bulk. A special patented, *concealed support* eliminates unsightly mullions and butted construction permitting superior strength with no added weight.

EASY TO INSTALL

#276 grilles are light in weight—easy to carry—easy to fit—easy to put in place. *Save much costly time and labor.*

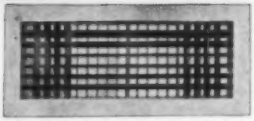
EXTRA VALUE AT LOWER COST

AIRFOIL grilles are priced down to give you more value—more performance—more efficiency—at less cost.

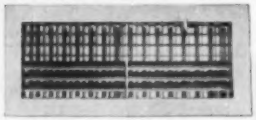
NOTE THESE OUTSTANDING AIRFOIL FEATURES . . .

- Smooth-as-glass AIRFOIL louvers.
- Positive shut-off.
- Extra-heavy frames.
- Individual louver adjustment.
- Airtight rubber gasket.
- Removable lever.

LOOK TO AIRFOIL FOR THE FINEST



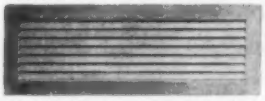
L-270 4-way directional grille for complete control of air stream.



L-274 Double directional grille with multi-shutter damper.

S-8 4-way grille with louvers on ½" spaced front.

RL-21 Return air grille of fixed deflection type with closely spaced louvers.



RL-230 Return air grille incorporates rugged construction and smart design.

AG-25 Volume controller designed to fit behind grille.

CHECK TYPE OF GRILLE ON WHICH INFORMATION IS DESIRED

- ☐ Air conditioning outlets
- ☐ Return air grilles and registers
- ☐ Volume controllers
- ☐ Perforated metal and ornamental grilles
- ☐ Door ventilators
- ☐ Special made-to-order grilles

TITUS MANUFACTURING CORP., WATERLOO, IOWA

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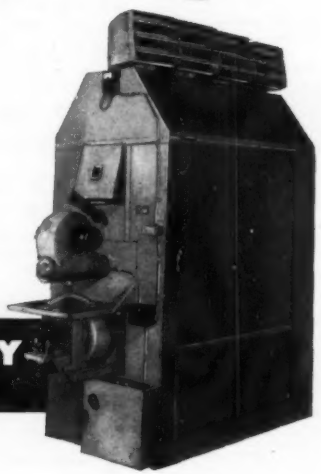
A Champion Wins On the Most Good Points

The champion of direct fired Unit Heaters is Olson — and Olson Heaters win in all phases. But from a rugged standpoint alone, here are the most durable heater construction features that *anyone's* money will buy. A rigid base, free from vibration, low fan speed, over size drive, heavy shaft, large self-aligning ball bearings, heavy outside casing with built in radiation shields, ample relief and access doors.

If you need a champion, long life heater — then you need an Olson Heater.



ARTHUR A. OLSON & COMPANY
BROAD ST. CANFIELD, OHIO

WRITE FOR COMPLETE INFORMATION AND ENGINEERING DATA.

● Now you can get famous Kno-Draft efficiency in a *square* diffuser — complete with built-in volume control, circular air patterns, and the sturdy construction that characterizes all Kno-Draft Air Diffusers.

The picture shows the Kno-Draft *Square* Diffuser, Type KPT, designed for T-bar installations. It snaps easily and snugly into perforated acoustical-type ceilings. For overlapping installation, Type KP is the unit to use.

Heating and air conditioning men who have installed the new Kno-Draft *Square* Diffusers will tell you these handsome units do an outstanding job. Naturally. They're made by men who have been "engineering air" for more than twenty years.

Quickest way to get full engineering information on Kno-Draft *Square* Diffusers is to clip the coupon and mail it to W. B. Connor Engineering Corporation, Danbury, Connecticut.

CONNOR

kno·draft®

adjustable air diffusers

W. B. CONNOR ENGINEERING CORP.
Dept. G-102, Danbury, Connecticut

Please RUSH full information on the new Kno-Draft *Square* Diffusers.

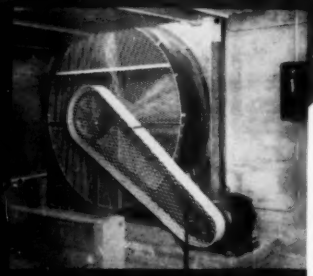
Name.....

Position.....

Company.....

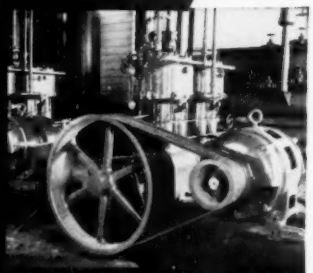
Street.....

City.....Zone.....State.....



Century motor driving a large fan.

WHY Century MOTORIZED EQUIPMENT KEEPS YOUR CUSTOMERS *SATISFIED...*

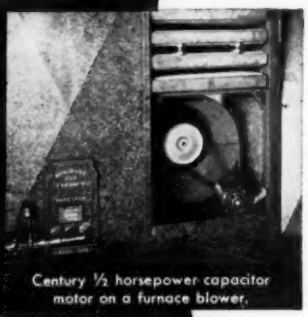


Two 100 horsepower Century motors driving refrigeration compressors.

The motor specifications—where skillfully selected—to assure the TOP PERFORMANCE and DEPENDABLE QUIET SERVICE that is built into each class of equipment.

Refrigeration compressors require one combination of operating characteristics and specifications—fans and blowers another combination—various types of heating equipment still another.

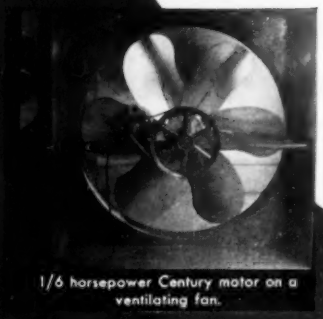
In over 50 years, Century has developed a wide line of types of motors with literally hundreds of specifications to choose from. It is easy to ENGINEER YOUR PRODUCT PERFORMANCE—THROUGH SKILLFUL MOTOR APPLICATION.



Century ½ horsepower capacitor motor on a furnace blower.

If you have motor service problems, phone or write to any of Century's 28 District offices regarding Century's national network of service stations—the motor exchange plan will serve you whether your motors are in or out of warranty.

Specify Century Motorized Equipment—get top equipment performance—dependable quiet service—keep your customers satisfied.

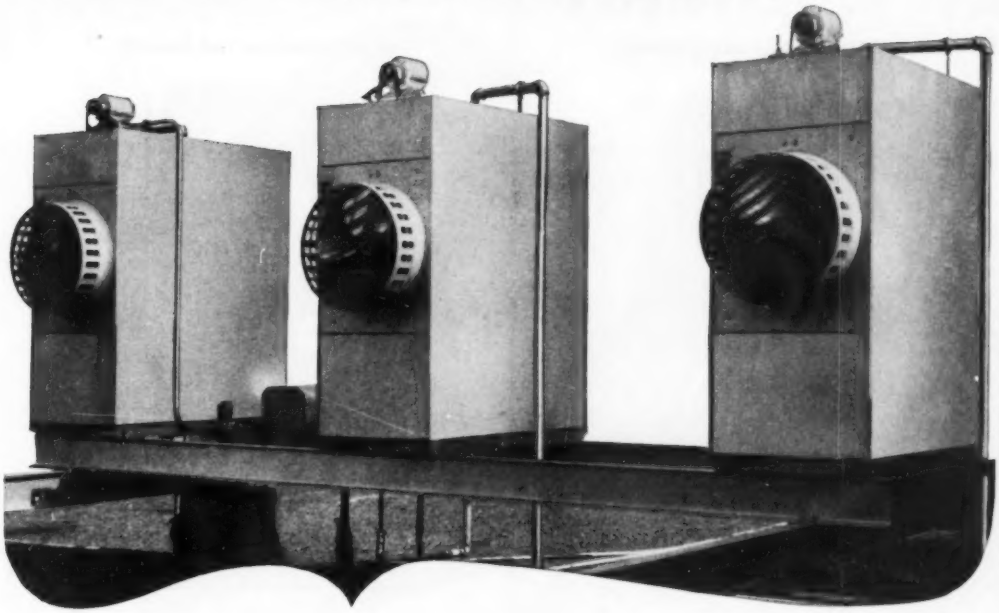


1/6 horsepower Century motor on a ventilating fan.

CENTURY ELECTRIC CO
1806 Pine Street • St. Lo

Century C MOTORS

MARLEY AQUATOWERS...



...teamed for Flexibility

producers of

DOUBLE-FLOW TOWERS
AQUATOWERS
DOUBLE-FLOW AQUATOWERS
DRICOOLERS
NATURAL DRAFT TOWERS
CONVENTIONAL TOWERS
SPRAY NOZZLES

With the increasing popularity of "zone cooling," multiple installations of Marley Aquatowers appear on more and more buildings. This system of cooling individual areas with separate systems offers true flexibility of operation: no complete shutdowns for maintenance; varying schedules of operation with consequence power and water economy.

Multiple Aquatower installations also offer construction economies where hoisting larger equipment is a problem. Added plant capacity and service for individual tenants also are provided simply and with uniformity of appearance by these multiple installations.

This year more thousands of Aquatowers are in service, singly and as multiple units, giving complete satisfaction to owners and installers. With every increase in demand for cooling towers, Aquatowers constantly fill the greatest proportion of the total requirement.

MARLEY

The Marley Company, Inc.

Offices in 50 Cities

Kansas City 5, Missouri

GENERAL CONTROLS T-70A ROOM THERMOSTAT

GENERAL CONTROLS T-70T TIMER THERMOSTAT

FOR INSTALLATIONS THAT STAY PROFITABLE

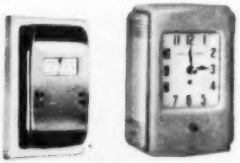
In General Controls thermostats you find the rare balance of extreme simplicity and day-in-day-out consistency in performance. Replacements and service calls are minimized when you install these dependable instruments. General Controls installations ARE profitable and STAY profitable.

The T-70A Thermostat combines design simplicity for room temperature control with easy vision thermometer and clearly graduated temperature dial.

Model T-70T Timer Thermostat provides continuous heating control with selective settings for both day and night periods, plus a timing mechanism which automatically changes from day setting to night or vice versa. Maximum reduced temperature "off time" of 13½ hours is available from the jeweled timer movement. Daytime temperature setting may be resumed by turning timer to zero.

Both models are bi-metal type with permanent magnet snap-action contacts and roll type temperature dials. Thermostats respond not only to convected heat but to radiant heat as well. Their extremely shallow profile makes them inconspicuous and extremely adaptable.

Competitive in price and richly streamlined with lustrous, life-time stainless finish, these modern, trouble-free instruments enhance the appearance of any room—are highly salable to all types of users—at profits that stay profits.



A WINNING COMBINATION

Mount this Model T-70Q Day-Nite Thermostat in the heat sensitive area. Mount the Type 5-R Electric Wall Clock Time Switch for continued operation in the bedroom, hall or other place where the householder finds it most convenient to change on-off settings when desired.

GENERAL CONTROLS

Glendale 1, California — Skokie, Illinois

Manufacturers of Automatic Pressure, Temperature, Level and Flow Controls for Heating, Home Appliances, Refrigeration, Industrial and Aircraft Applications.

FACTORY BRANCHES IN 32 PRINCIPAL CITIES

SEE YOUR CLASSIFIED TELEPHONE DIRECTORY

The Perfect

REFRIGERATION TUBE

Deserves the

Perfect Package

Now in the famous HANDIGRIP CARTON

Because the *Handigrip Carton** has so many proven advantages, Lewin-Mathes refrigeration tube is now available in this perfect package.

- INDIVIDUALLY PACKED
- SAFE PROTECTION FOR RESHIPMENT
- EASY TO HANDLE
- EASY TO STOCK
- EASY TO IDENTIFY

Only Lewin-Mathes copper tube is packed in the Handigrip Carton*

*Patent Applied For

LEWIN MATHES

LEWIN-MATHES COMPANY · · SAINT LOUIS, MISSOURI

MANUFACTURERS OF COPPER AND BRASS TUBE, PIPE AND FITTINGS

LOOKING FOR WAYS TO CUT COSTS?

Your only answer may be in using your labor more efficiently..

1. No More Shoveling, Men Are Free For Other Duties...A Tremendous Saving In Man-Power Alone! Then Consider All The Other Low-Cost Advantages....

2. SIDE DUMP ASH PLATES, AN OPTIONAL FEATURE OF CANTON BINFEEDS, ELIMINATE SMOKE, FUMES, DUST IN BOILER ROOM... ASH SPRAY PIPES SIMPLIFY CLEANING.

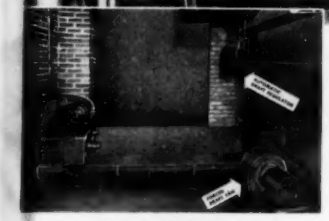
3. COMPLETE CONTROL PANEL ENGINEERED FOR THE JOB IS WIRED AND TESTED AT THE FACTORY — PAYS FOR ITSELF BY SIMPLIFYING WIRING ON THE JOB SITE AND GUARANTEEING PROPER CONTROL OPERATION. MODULATING COMBUSTION AND DRAFT CONTROLS ARE AVAILABLE ON ALL MODELS.

4. AS AUTOMATIC NOW, AS GAS OR OIL.

5. CANTON BINFEED STOKERS HOLD STEAM PRESSURES CONSTANT, REDUCE FUEL COSTS BY PRODUCING MORE HEAT FROM THE FUEL; ALLOW CHEAPER GRADES AND SIZES OF COAL TO BE USED EFFICIENTLY.

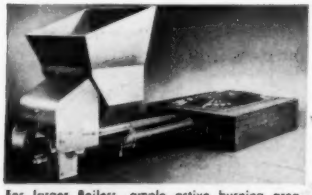
6. NO NEED FOR SEPARATE INCINERATOR WITH CANTON SIDE DUMP BINFEEDS, AS THEY PROVIDE FOR BURNING REFUSE.

7. FLAT PLATE TOP OF WORM CASING CAN BE INSTALLED AT FLOOR LEVEL, WHEN DESIRABLE, FOR TRUCKS OR TRAFFIC TO PASS OVER.



New Canton Binfeed with coal conveyor rear of boiler. Note fan and automatic draft regulator are also at rear of boiler, out of the way.

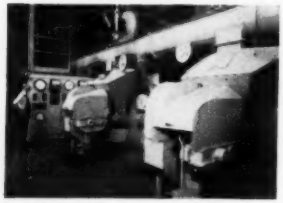
Flo-Tube Coal Conveyors fill one or more hoppers direct from bin or pile. Are also used horizontally as in picture at right, with gate valves to control hopper feeding.



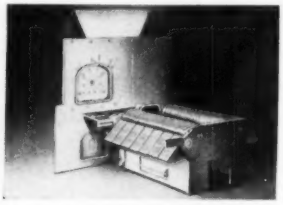
For larger Boilers, ample active burning area is provided by Canton's newest Tuyere design with measured air graduation and fin-cooling ribs. Dead plate type illustrated here . . . also available in side ash dumping type.

LOOK AT THE NEW CANTON STOKER DEVELOPMENTS

Binfeed Stokers cut costs immediately for every heat and power demand by allowing more efficient use of labor. High wages, going higher, have speeded up the need for automatic handling of coal—the lowest price fuel. It will pay to look into the new developments by Canton Stoker, specialists in COAL FIRING, HANDLING and CONTROL equipment. Representatives in principal cities of the U. S. have complete information, or write direct.



Ever see a neater installation? This photo is NOT RETOUCHED. It is Canton Stoker installation, St. Mary's Hospital, Niagara Falls, New York. Hoppers are fed horizontally, direct from bin by screw conveyors.



New Canton "SINGLE-SIDE-DUMP" model, engineered and built for narrow boilers.

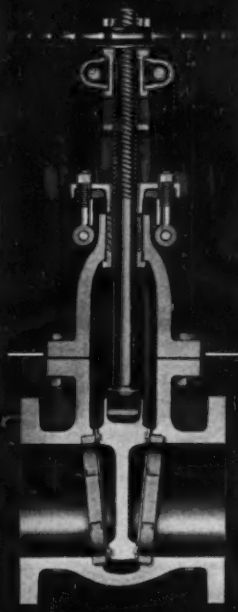
"TURBO-AIRE" JETS — for smoke abatement, firing efficiency.

***WRITE FOR NEWEST BROCHURE* on Binfeed Stokers. It contains blue-prints and plan of a model stoker installation. A great help in planning or remodeling.**

CANTON STOKERS

CANTON STOKER CORPORATION

2400 ANDREW PLACE S. W. CANTON, OHIO



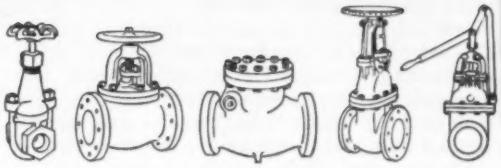
IRON

COMPLETE LINES OF IRON VALVES AND PIPE FITTINGS are manufactured by Walworth in a variety of types, pressure ratings, sizes, and patterns for general industrial use.

Walworth also manufactures complete lines of valves (including Lubricated Plug Valves), and pipe fittings made of steel, bronze, and special alloys.

These valves and pipe fittings, plus Walworth-made pipe wrenches total approximately 50,000 items and are sold through distributors in principal centers throughout the world.

Walworth engineers will be glad to help you with your problems. For further information call your local distributor, nearest Walworth sales office, or write to Walworth Company, General Offices, 60 East 42nd Street, New York 17, New York.



Iron valves in gate, globe, angle, check, and lubricated plug types are manufactured by Walworth. Illustrated is a sectional view of a Walworth No. 726F Standard Iron Body, Bronze Mounted, Wedge Gate Valve with flanged ends. This line of valves is available in sizes 2 to 30 inches. Similar valves of All-Iron type are also available.

WALWORTH

Manufacturers since 1842

valves . . . pipe fittings . . . pipe wrenches

60 East 42nd Street, New York 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

4 EXTRA THREADS

FOR LONGER LEAKTIGHT SERVICE

Leaky valves are bound to make home-owners unhappy. Why not protect your customers against this common source of trouble by insisting that Ohio Brass valves be installed on hot and cold water lines?

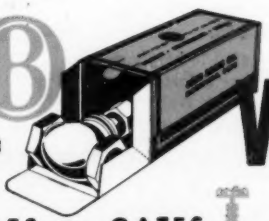
Four extra threads on the centerpiece are one reason why O-B valves seldom leak around the stem. The extra take-up thus provided allows the packing nut to be pulled down as required. This keeps the long split-ring packing snugly compressed — a safe guard against stem leaks even after years of service.

On your next job be sure to specify Ohio Brass valves. Your local distributor carries them in a complete line of low pressure globes, gates, angles and checks. He will be glad to provide you with valves or any of your other plumbing and heating needs.

O-B No. 3
LINE GLOBE VALVE

With composition disc. Also available in angle type or with solder type ends ¼" to 2" in size.

4207-V

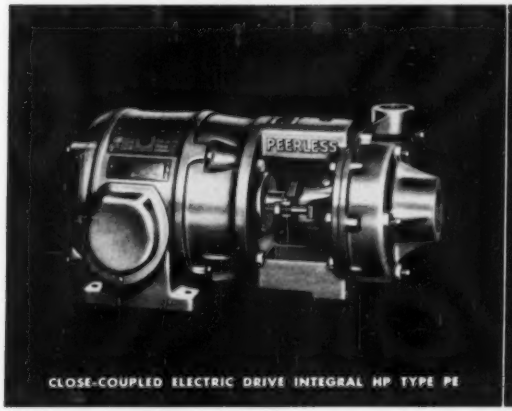


Ohio Brass VALVES

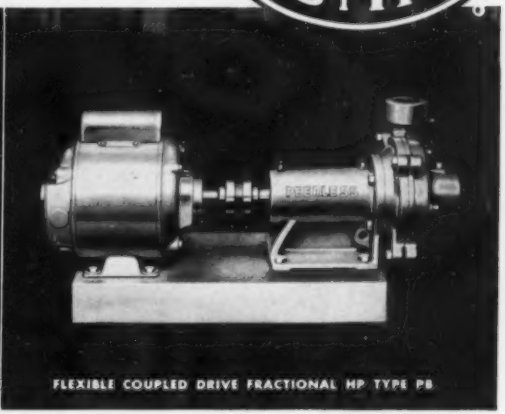
BRONZE GLOBES ANGLES GATES AND CHECKS

CLOSE-COUPLED ELECTRIC, BELTED OR FLEXIBLE COUPLED END-SUCTION PUMPS FOR ALL WATER PUMPING PURPOSES

PEERLESS PUMP



CLOSE-COUPLED ELECTRIC DRIVE INTEGRAL HP TYPE PE



FLEXIBLE COUPLED DRIVE FRACTIONAL HP TYPE PB

THE PEERLESS *Fluidyne* LINE

IDEAL FOR CONDENSATE WATER PUMPING, EVAPORATIVE COOLERS, HOT OR COLD WATER AND PUMPING OF OTHER CLEAR MILD SOLUTIONS

Now, more than ever, it's important to specify and buy dependable, efficient pumps for both new and replacement services.

And, now from one of the broadest lines of general purpose pumps offered by any manufacturer, you can satisfy your requirements for both peak performance and prompt delivery, in many sizes, with pumps in the versatile Peerless Fluidyne line, illustrated here.

From the Peerless Fluidyne line, two general types of pumps are available. One type is a close-coupled, electric drive pump, designated as the Peerless Type PE; the other is a bracket-mounted pump for flexible-coupled, V- or flat belt pulley drive, designated as the Peerless Type PB.

Both types are economical both in first cost and in service. Both are built for easy maintenance, if service is required. Both are rugged and compact in design. Both are of good design, fitting neatly into any piping and pumping systems. Both embody superior hydraulic characteristics.

Read the specifications at the right. One or several types of Peerless Fluidyne pumps is sure to match your specifications. And delivery is available from two Peerless factories, located at Indianapolis, Indiana and Los Angeles, California.

SIZES:

Type PE HP Range
¼ to 1½ hp fractional hp sizes
2 to 60 hp integral hp sizes

Type PB HP Range
¼ to 1½ hp fractional hp sizes
2 to 150 hp integral hp sizes

CAPACITIES:

Type PE
Up to 65 gpm; fractional hp sizes
Up to 1000 gpm; integral hp sizes

Type PB
Up to 50 gpm; fractional hp sizes
Up to 5500 gpm; integral hp sizes

HEADS:

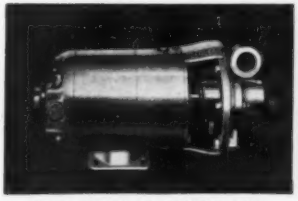
Type PE
Up to 110 ft.; fractional hp sizes
Up to 200 ft.; integral hp sizes

Type PB
Up to 90 ft.; fractional hp sizes
Up to 260 ft.; integral hp sizes

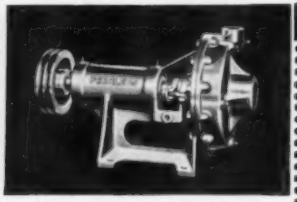
PEERLESS PUMP DIVISION
FOOD MACHINERY AND CHEMICAL CORPORATION
Address Inquiries to Factories at:
Los Angeles 31, California or Indianapolis 8, Indiana.
Offices: New York, Atlanta, Fresno, Los Angeles, Chicago, St. Louis, Phoenix; Dallas, Plainview, Lubbock, Texas; Albuquerque, New Mexico.

PEERLESS PUMP fmc

NEW BULLETIN describes additional features of pumps in the Peerless Fluidyne line. Write for your copy of this 24-page fully illustrated and descriptive engineering bulletin today.



Electric drive fractional HP Type PE



V-Belt drive integral HP Type PB

MAIL COUPON TODAY

PEERLESS PUMP DIVISION
FOOD MACHINERY AND CHEMICAL CORP.
Los Angeles 31, California

Please send me a copy of Peerless Fluidyne Pump Bulletin No. B-2300.

NAME_____

COMPANY_____

STREET_____

CITY_____ STATE_____

HPAC

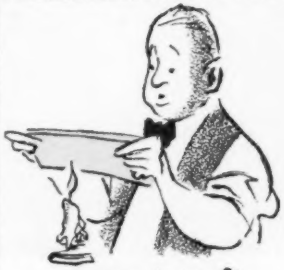
You can compress it...

...shake it...

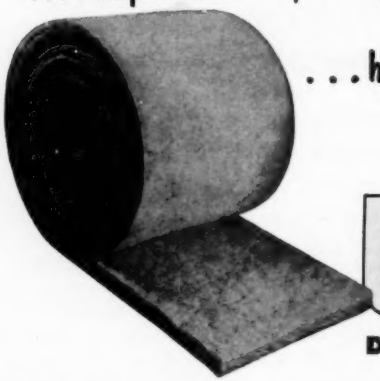
...wet it...

...bump it...

...bend it...



...expose it to fire...



...here's the **INSULATION**

THAT CAN TAKE IT!

ULTRALITE

DUCT INSULATION AND DUCT LINER

No other insulation can take so many kinds of punishment—*and still retain its original thermal and acoustical properties*—as ULTRALITE, the long glass fiber insulation.

Contractors and applicators who use ULTRALITE Duct Insulation and Duct Liner report that these rugged-yet-resilient insulations pay off handsomely. For example, ULTRALITE cuts application costs way down. It's easy to carry, easy to cut, quickly runs around curves and corners. It can be fastened with adhesives, wires—even staples.

Then, too, there's no waste with ULTRALITE. It won't rot, burn, chip, dent, flake, break or deteriorate with age. In the shop, or on the job, it's easy to handle, inexpensive to ship and store.

ULTRALITE Duct Insulation and Duct Liner are available plain or with a wide variety of vapor barrier facings to solve any condensation problem and to enhance the appearance of the job. Sweet's File (Architectural) Section 10 carries complete details, and local distributors in 71 cities (listed in the Yellow Pages) stock ULTRALITE to give you prompt, on-the-spot service and delivery. Call your ULTRALITE distributor—or write today for samples and full details.

GUSTIN-BACON MANUFACTURING CO.

210 W. 10th St., Kansas City, Missouri

New York • Chicago • Philadelphia • San Francisco • Los Angeles • Houston • Tulsa • Fort Worth • Detroit

Keeping pace with the Nation's industrial requirements through research and development—since 1898.

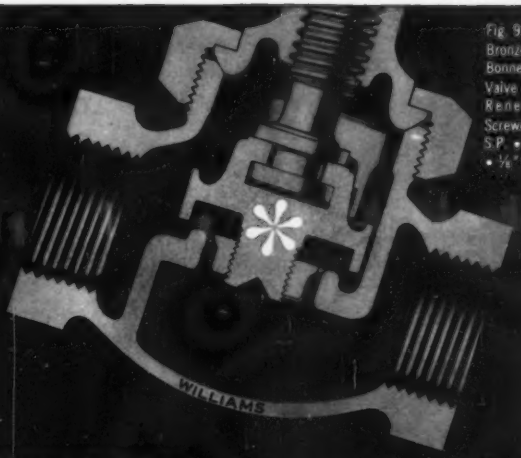


Fig. 912—913
Bronze Vulcodisc Union Bonnet Globe and Angle Valve • Integral or Renewable Seat • Screwed Ends • 200 lbs. S.P. • 400 lbs. W.O.G. • ⅛" to 3".

REDUCE COSTLY "SHUTDOWN" TIME . . .

Specify D.T. Williams "Vulcodisc" Valves

RUGGED CONSTRUCTION! Valve is quality engineered from high grade steam bronze for greatest wall strength —longest service life!

RENEWABLE DISCS! Can be quickly replaced without removing valve from line—prevent service delays!

SPECIAL "VULCO" DISC COMPOSITION! Allows foreign matter to impregnate disc harmlessly—prevents shutdowns due to disc chipping or cutting.

3 DIFFERENT DISCS AVAILABLE! Three special composition discs are available for use in Vulcodisc Valves. Fig. 825 for steam; Fig. 826, air and water; Fig. 827, oil or solvents.
For additional information either see your nearest jobber or write for literature.

Fig. 1176

Fig. 840

Fig. 1086

Fig. 856

Fig. 1176
Bronze Vulcodisc Quick Operating Union Bonnet Globe Valve • Screwed Ends • 200 lbs. S.P. • 400 lbs. W.O.G. • ¼" to 2"

Fig. 840
Bronze Vulcodisc Quick Operating Valve • Screwed Ends • 200 lbs. S.P. • 400 lbs. W.O.G. • ¼" to 2"

Fig. 856
Bronze Vulcodisc Horizontal Check Valve • Screwed Ends • 200 lbs. S.P. • 400 lbs. W.O.G. • ⅛" to 3"

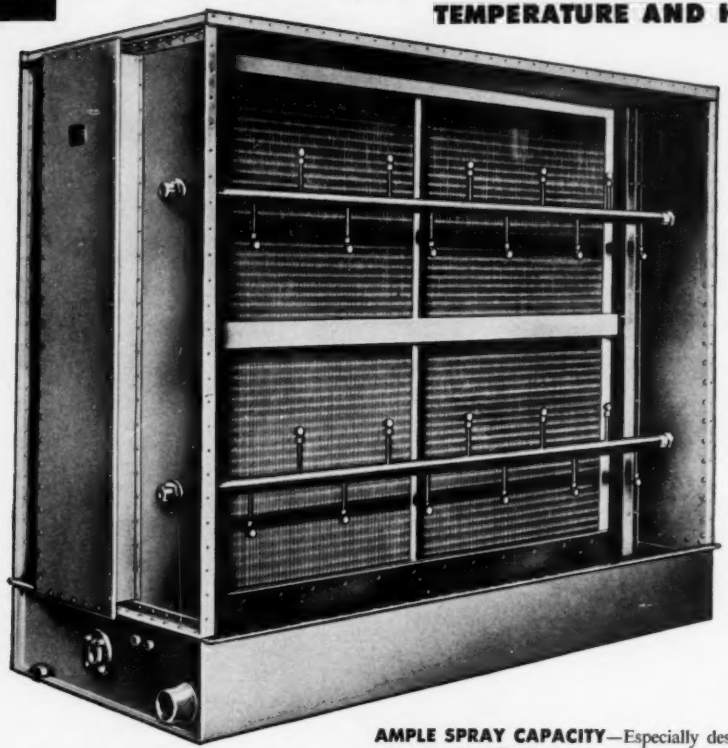
Fig. 1086
Bronze Vulcodisc Swing Check Valve • Screwed Ends • 200 lbs. S.P. • 400 lbs. W.O.G. • ¼" to 3"

GUARDIANS OF THE PIPELINES
D.T. Williams VALVES
THE D. T. WILLIAMS VALVE CO.
FOUNDED 1869
DIVISION OF The Schaible Company
1084 SUMMER STREET • CINCINNATI 4, OHIO

ANOTHER STURTEVANT DEVELOPMENT!

NEW SURFACE DEHUMIDIFIER

(SPRAYED COIL) **FOR CLOSE CONTROL OF TEMPERATURE AND HUMIDITY**



This improved Surface Dehumidifier combines the effects of surface cooling and evaporative cooling. It offers the added advantages of keeping the coil surface free from foreign matter and odors by continually spraying and washing them down.

EXCLUSIVE STURTEVANT FEATURES

BALANCED AIR FLOW—Moisture eliminators direct the leaving air in *two divergent streams.* This minimizes air spin and insures rated fan performance.

RELIABLE COIL PERFORMANCE—Proven Westinghouse-Sturtevant *plate fin* water or dehumidifying coils meet catalog ratings.

AMPLE SPRAY CAPACITY—Especially designed spray nozzles effectively wet and cleanse the entire surface of the coils.

EASY ACCESS—Coil connections accessible by removal of the cover plate on the coil connection box *without disturbing* piping and insulation.

RUGGED CONSTRUCTION—Airtight and watertight; casings are #16 gauge galvanized steel, reinforced with steel angles; tanks 3/16" thick steel asphalt coated.

ONE WARRANTY—Westinghouse makes all major components including coils. You get unit engineering and single equipment responsibility.

A new catalog, Number 1660, gives you complete data on how to select these surface dehumidifiers. Includes full psychrometric and coil performance data bound into one volume. For your free copy, call your local Westinghouse-Sturtevant office, or write: Westinghouse Electric Corp., Sturtevant Division, Hyde Park, Boston 36, Mass.

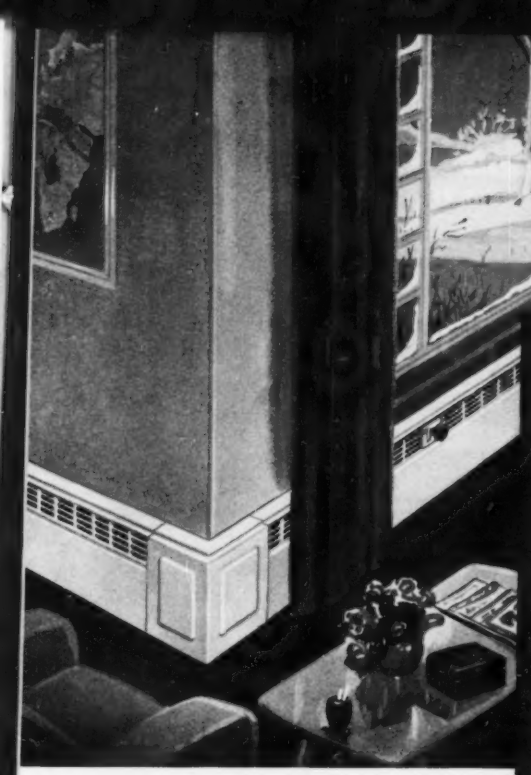
YOU CAN BE SURE...IF IT'S

Westinghouse

J-80283

AIR HANDLING

TUNE IN ON HISTORY! Only Westinghouse brings you complete coverage of political campaign over CBS television and radio.



KRITZER

BASEBOARD HEATING LINE

- Attaches to front grill
- Designed for fast, easy field installation
- Opens and closes dampers up to 10' long
- No springs—No hinges—No chains
- No screws—No tools

- Attaches to back plate
- Supports front plate
- Supports damper
- Supports slide cradle and coil
- No screws—No tools

- Grips fins of coil
- Slides on bracket
- Provides unlimited expansion capacity
- Self relocating after installation
- No screws—No tools

- Inside Corners
- Outside Corners
- Access Doors

KRITZER BASEBOARD HEATING has been selected for many of the country's outstanding residential, institutional, and commercial installations. Here are just a few of the reasons why:

1. Kritzer is a complete line, with 5 separate types to choose from; selecting the proper Kritzer Baseboard for any given requirement is easy and certain.

2. Kritzer Baseboard Heating, wherever installed, has earned universal recognition for its quality, performance and definite operating economies.

3. Kritzer Baseboard Heating is engineered for fast, easy field installation and designed to present the most attractive finished appearance.

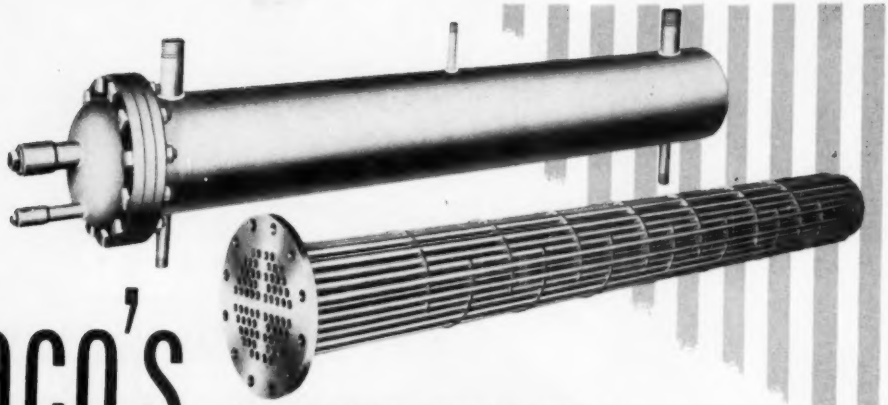
All of this, plus new features, too, are available to you only with Kritzer—THE COMPLETE BASEBOARD HEATING LINE.

For a comprehensive, well illustrated description of these and all other features of the complete Kritzer Baseboard Heating Line, write for your copy of Kritzer's new 16-page Baseboard Catalog: No. B752.

"IF IT'S KRITZER • IT'S RIGHT, SIR!"

KRITZER RADIANT COILS, INC.
2903 Lawrence Avenue, Chicago 25, Illinois

KRITZER REPRESENTATIVES ARE LISTED IN LOCAL DIRECTORIES



Taco's CWF DIRECT EXPANSION Evaporators (FOR LIQUID CHILLING OR WATER COOLING) Mean Greater Profits

FOR AIR CONDITIONING AND REFRIGERATION CONTRACTORS

Quality Construction and Better Design Give Long Life, Maintenance-Free, Low Cost Operation

TACO HEATERS, Incorporated, since 1920, has backed heating and air conditioning contractors with the highest quality heat exchangers, such as those illustrated in this ad: water heaters and coolers, fuel oil heaters, condensers, instantaneous water heaters, converters and tank heating units.

Now, Taco has increased its production facilities to match the air conditioning and refrigeration industry's growth. Taco's "know how" in large heat exchanger design and installation is at the service of all its friends in the industry.

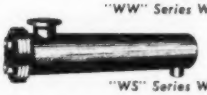
Better Heating-Better with Taco

Taco

TACO HEATERS, INCORPORATED • 137 SOUTH STREET, PROVIDENCE 3, R. I.

TACO MAKES A WIDE LINE OF SHELL & TUBE HEAT EXCHANGERS
4 of which are shown below

"WW" Series Water Heaters

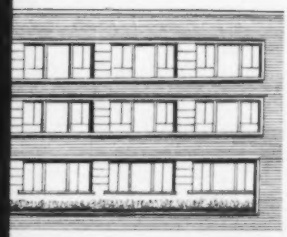


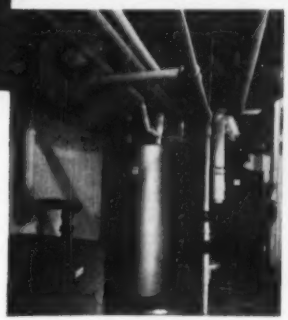
"WS" Series Water Heaters

"TU" Series Tank Heating Units

Straight Tube Heat Exchangers

on PEACHTREE street:





on SPANG® CW

In winter, as well as in summer, Atlanta's Red Cross blood bank *must* keep functioning. So Red Cross Officials selected materials for the heating system of their new headquarters building with extra-care —and placed their faith in reliable Spang CW for piping needs.

Wherever you go—North or South—you'll find architects, owners and contractors who insist on reliability insist on Spang Steel Pipe. Which is natural, for Spang Pipe is *quality-controlled* from raw material to final shipment. Thus it's always uniform in every way—always certain to give complete dependability and freedom from trouble.

What's more, it's easy to bend, easy to cut, easy to thread—all factors that pay off in longer tool life and faster installation.

So never take pipe that's "just as good"—insist on quality-controlled Spang Steel Pipe. You can't *see* this difference, but it's there. Your Spang Distributor can show you what we mean.

OWNER: AMERICAN RED CROSS, ATLANTA, GA.
ARCHITECTS: BODIN & LAMBERSON, ATLANTA, GA.
GENERAL CONTRACTOR: BARGE THOMPSON COMPANY, ATLANTA, GA.
PIPING CONTRACTOR: SOCKWELL CO., ATLANTA, GA.
PIPE: SPANG STANDARD CW BLACK IN SIZES FROM ½" TO 3"

SPANG

SPANG-CHALFANT

DIVISION OF THE NATIONAL SUPPLY COMPANY

General Sales Office: Pittsburgh 30, Pa. District Sales Offices: Atlanta, Boston, Detroit, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, St. Louis

going modern?

In design, it's hard to say. But you can be sure that churchmen are seeing the advantages of churches that offer modern comfort.

Surveys show that in the next few years, a large number of churches will be air conditioned.

It's one of the best investments a church can make. It increases attendance during summer months. It creates more interest in services by eliminating discomfort and traffic noises. And it means fewer cleaning and redecorating bills.

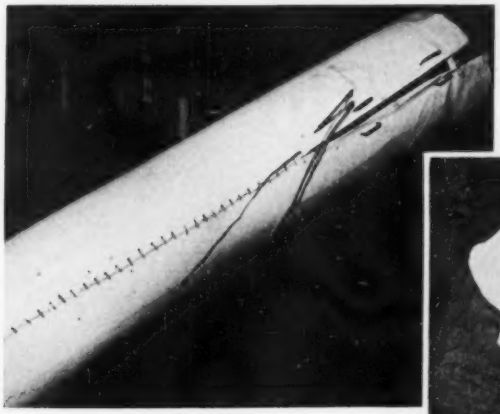
But church installations can present difficult problems. Ducts must be concealed, equipment must be especially quiet. The system must be able to handle infrequent building capacities and sudden cooling loads. And peculiar construction features, like high domes, can add to the problem.

But with Carrier's line of matched products, you can build a system around any problems. It's equipment designed and built by men with half a century of air conditioning experience behind them, including some of the larger churches in the country. Carrier Corporation, Syracuse, New York *—for 50 years . . . the people who know air conditioning best.*

Carrier

AIR CONDITIONING / REFRIGERATION / INDUSTRIAL HEATING

Eliminate costly sewing of Lagging Cloths..



by specifying Foster LAGFAS as adhesive and surface coating.

Labor costs are reduced by as much as forty per-cent when fabric coverings are *cemented* over pipe insulation with Foster Lagfas (81-42W). Besides this astounding saving in application costs, a much more durable and attractive finish results.

Lagfas, the pioneer lagging adhesive—required in many military and major industrial specifications —is a true-white, free-flowing resin emulsion possessing remarkable adhesive and protective powers for canvas and other fabrics over thermal insulation. Lagfas is fire-retardant, and resists yellowing; it is *non-toxic* to workmen, and dependably uniform. Fabrics coated with Lagfas are easily washed without absorbing moisture, and readily painted without further sizing.

A TYPICAL SPECIFICATION

When insulation has been installed according to specification or following the practice approved by the manufacturer, all longitudinal and joint laps of canvas or asbestos cloth jacket shall be adhered with brush application of Lagfas (81-42W) as manufactured by Benjamin Foster Company, Philadelphia 31, Pa. Laps shall be drawn snugly over insulation to prevent wrinkles and holidays.

To make exterior fabric surface washable, water-resistant, and paintable, and to shrink canvas tighter onto insulation, a final coat of Lagfas shall be applied to entire surface.

BENJAMIN FOSTER COMPANY · PHILADELPHIA 31, PA.

Makers of LAGFAS • SEALFAS • FIRE-RETARDANT MASTICS • TRI-GUARD COATINGS • ADHESIVES, SEALERS, AND SURFACE COATINGS FOR INSULATION AND INDUSTRIAL USES

For small pipe heating systems

U·S·S Galvanized Steel Sheets

SMALL diameter pipes are one of the newest trends in warm air heating installations. Many contractors are finding this system makes it easier to sell modernization jobs where space is at a premium.

In installing small pipe systems—as well as conventional ductwork arrangements—contractors find they can do their best jobs with U·S·S Galvanized Steel Sheets. These sheets can be rolled, bent, cut, formed and soldered without difficulty. And the zinc coating gives the installation lasting protection against rust and corrosion.

For the finest performance, both in fabrication and service, use U·S·S Galvanized Steel Sheets. Your customers know the United States Steel name. . . they recognize that it stands for the best in steel.

U·S·S GALVANIZED STEEL SHEETS

UNITED STATES STEEL COMPANY, PITTSBURGH • COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA. • UNITED STATES STEEL SUPPLY DIVISION, WAREHOUSE DISTRIBUTORS, COAST-TO-COAST
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS

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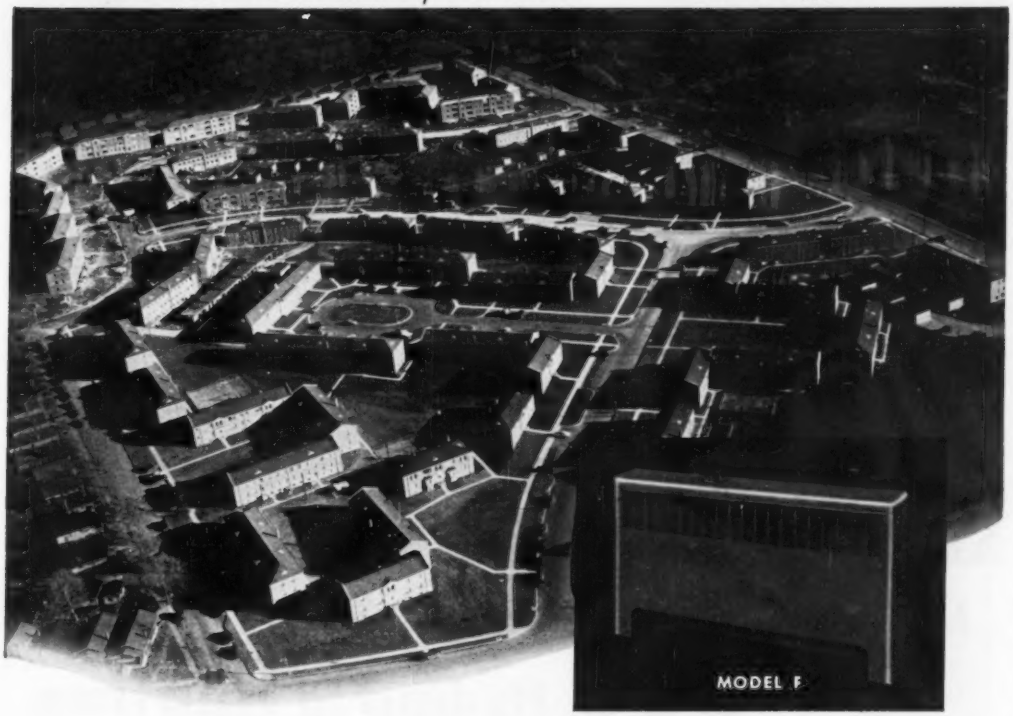
UNITED STATES STEEL

HAMPTON GARDENS, *St. Louis*

Leo F. Abrams, architect
Natkin & Co., heating contractors
Webb & Knapp, Inc.



3,200 AIRTHERM CONVECTORS

selected to comfortably heat the 500 dwelling units of this new, self-contained residential community for Mid-America

Here Airtherm Convectors fit functionally into the handsome Colonial design, demonstrating their wide adaptability to all types of decor, from traditional to modern. Savings in labor and installation costs were made possible by Airtherm's simplicity and ease in handling and connecting.

Airtherm Convectors are available for wall, recessed, or free-standing installation.

For Heating Satisfaction... Think First of *Airtherm*

Oil or Gas Direct Fired Heaters | Horizontal Type Unit Heaters | Vertical Type Unit Heaters | Centrifugal Fan Type Unit Heaters

AIRTHERM MANUFACTURING COMPANY
711 South Spring Avenue • St. Louis 10, Missouri

133

Every inch is livable space with

B & G *Hydro-Flo* Heating

The system of *controlled radiant* heating which meets the demands of modern architecture

B & G *Hydro-Flo* Heating solves the problem of properly heating homes with large glass areas. Radiant floor or ceiling panels, or baseboard panels effectively prevent cold down-drafts from the windows . . . keep floors warm and draft-free.

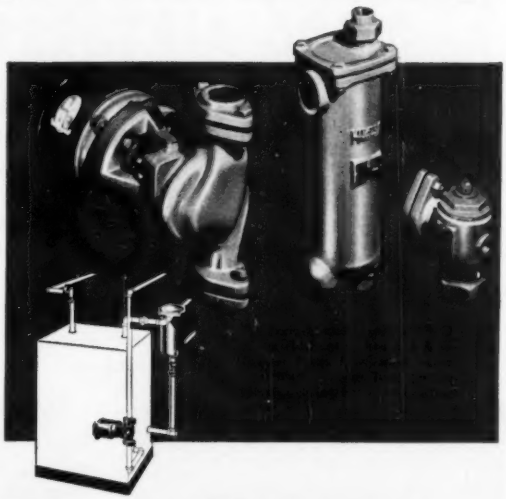
B & G *Hydro-Flo* Heating is a *forced hot water system*—which means that the heat supply is always under positive control. The temperature of the circulating water is *automatically* raised or lowered to meet every change in the weather. Even in spring and fall, when only a little heat is needed, indoor temperature is kept exactly at the comfort level.

That's why a B & G *Hydro-Flo* System costs so little to operate. No overheating to cause fuel waste . . . but always plenty of heat when the thermometer hits bottom.

Abundant hot water—winter and summer

The modern home needs hot water as never before . . . automatic washers and showers require ample quantities for satisfactory operation. The Water Heater of a *Hydro-Flo* System produces a virtually inexhaustible supply, all year 'round.

Send for catalog of B & G *Hydro-Flo* Products.



B & G *HYDRO-FLO* EQUIPMENT PROTECTS YOUR MOST VALUABLE ASSET—*CUSTOMER SATISFACTION*

*Reg. U. S. Pat. Off.

BELL & GOSSETT

COMPANY

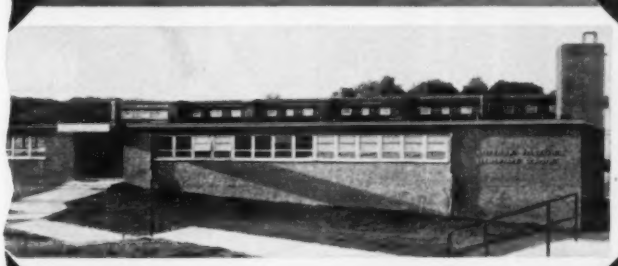
Dept. CR-5, Morton Grove, Ill.

Canadian Licensee: S. A. Armstrong Ltd., 1400 O'Connor Drive, Toronto, Canada

PAGE 1

1952 TEMPERATURE CONTROL ALBUM

the place



Hoffman Boston Elementary School
Arlington, Virginia

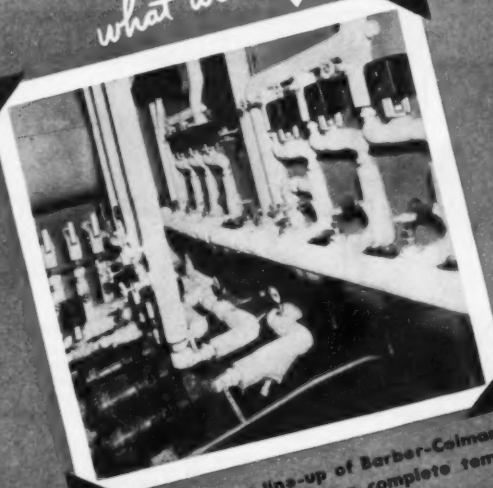
who was there

Architect:
Ronald S. Senseman
Washington, D. C.

Engineer:
A. Dee Counts
Washington, D. C.

Heating Contractor:
E. J. Febrey & Co.
Washington, D. C.

what we did



Above photograph shows line-up of Barber-Colman Motor-Operated Valves, part of a complete temperature control system.

notes of interest

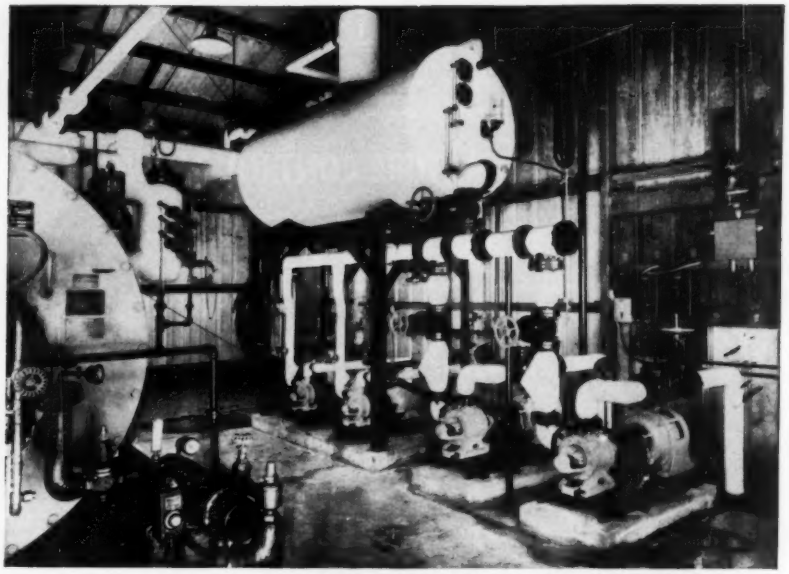
A central hot water converter is controlled by a Barber-Colman CYDK Dual Bulb Microtherm*, 1 to 1 ratio, controlling a steam valve. The radiant heating system is divided into three zones—two zones of three classrooms each, and one office section zone. Each classroom has a valve and thermostat. When all rooms in a zone are satisfied, the pump for that zone stops. When the office section is satisfied, the valve for that zone closes and, in turn, stops the pump.

*Reg. U.S. Pat. Off.

BARBER-COLMAN COMPANY
1228 ROCK STREET • ROCKFORD, ILLINOIS

For the complete story on Barber-Colman Controls, write for Catalog F-2287-3.

BARBER COLMAN

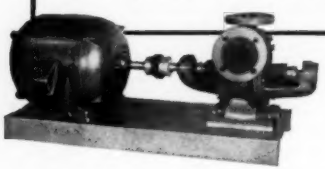


Schaub Duplex Deaerator System, installed in a new Pacific Northwest plant, handling one 100 H.P. and one 500 H. P. packaged boilers, 150 lbs. working pressure.

You Get **MORE** in a **SCHAUB**

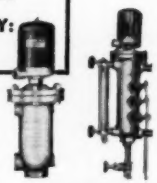
BOILER RETURN SYSTEM

THIS EXCLUSIVE COMBINATION OF *"Plus Values"* TELLS WHY:



Schaub Master-Bilt Turbine Pump

Patented fleximatic shaft seals and prelubricated ball bearings mean no packing and no greasing — *ever!* When you install a Schaub Master-Bilt Pump you can forget about it.



Ultra-Dependable MAGNETROL Boiler Water Level Control

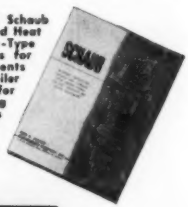
Combination pump control and low water safety cut-off. Friction-free Magnetrol assures boiler safety. No bellows to stiffen, no packing in head, no tricky electrode circuits to fail. All models approved by Underwriters' Laboratories, Inc.

Chromoscid-Lined Receiver

10-year guarantee against corrosion. Schaub engineers developed Chromoscid lining by working with leading chemical researchers. You're protected against costly and premature replacements. No more rust-clogged systems.

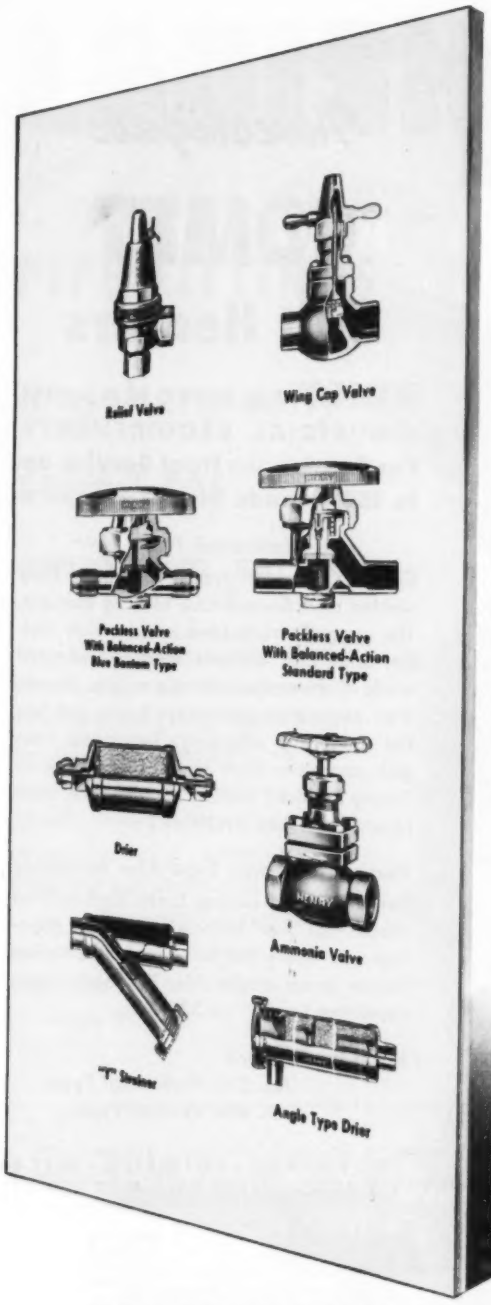
Each of these, along with other features, combine to produce the high overall efficiency, economy and long-lasting service characteristic of every Schaub System. Operators who buy on the basis of facts and performance find that they get more out of a Schaub System because a Schaub System has *more to give them.* When a Schaub System is compared with any other, the *least* difference is the difference in price! That's just another way of saying *you pay less per year for a Schaub System.*

Know the Facts! Schaub also builds *Patented* Heat Reclaim and Spray-Type Deaerating Systems for exacting requirements from 10 to 1000 boiler horse power. Write for new Schaub Catalog No. 55 which gives more information on all types of Schaub Systems.



FRED H. SCHAUB ENGINEERING CO.

2116 S. Marshall Boulevard **Chicago 23, Illinois**



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HENRY

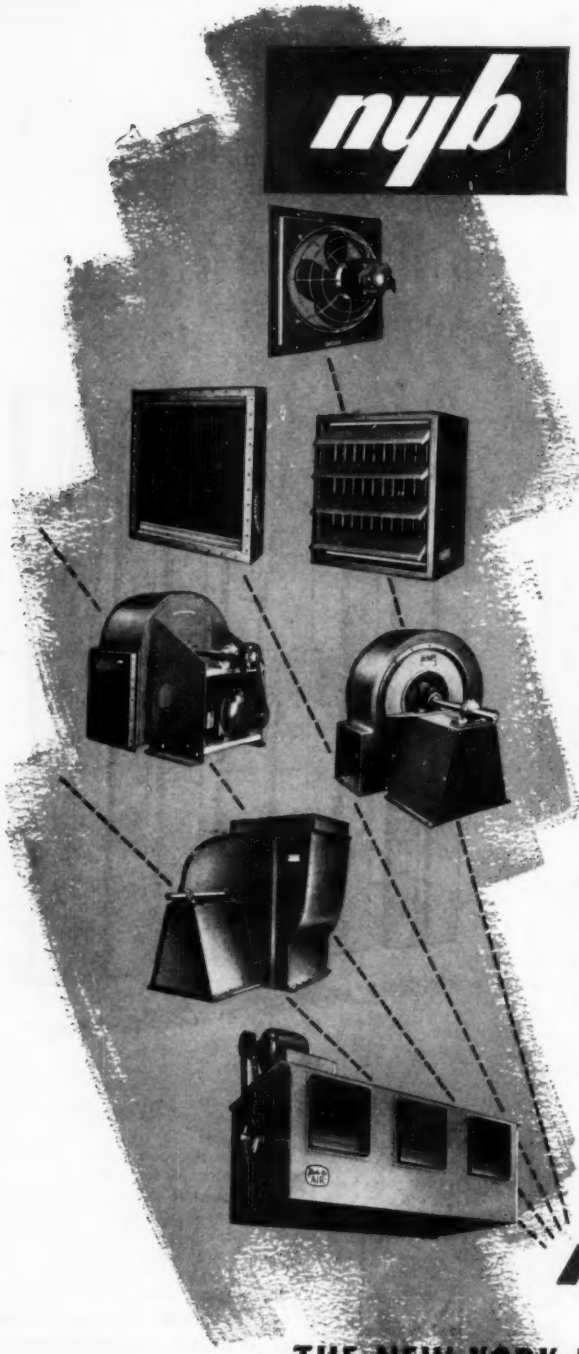
VALVES, DRIERS & STRAINERS

HENRY VALVE CO.

HENRY VALVE CO
CONTROLLING FLOW
SINCE 1914

MELROSE PARK, ILL. (Chicago Suburb)
CABLE: HEVALCO MELROSE PARK, ILL.

Valves • Driers • Strainers • Control Devices and Accessories for Refrigeration, Air Conditioning and Industrial Applications



nyb

Investigate

COMET

Unit Heaters

BUILT TO MEET MODERN INDUSTRIAL REQUIREMENTS
For Continuous Heat Service up to 150 Pounds Steam Pressure

Horizontal Type

Ceiling suspension type with heavy duty welded steel fin-and-tube heating element. The rugged arc-welded construction outperforms and outlasts heating elements made of thinner non-ferrous metals. Avoids their expansion-contraction faults, yet has the same BTU efficiency. Ten basic sizes with capacities from 30 Mbh to 490 Mbh. Totally enclosed motors. (Extra heavy non-ferrous coils also available.)

Vertical Projection Type Also Available

For efficient heating from high-ceiling areas—for door heaters over small openings—or where the horizontal type Comet Heater is not applicable. Ten basic sizes; capacities from 27 to 332 Mbh.

Write for Bulletins

No. 513 Horizontal Type
No. 484 Vertical Type

FANS • BLOWERS • UNIT HEATERS • MAKE-UP AIR UNITS • HEAVY DUTY HEAT SURFACE

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THE NEW YORK BLOWER COMPANY

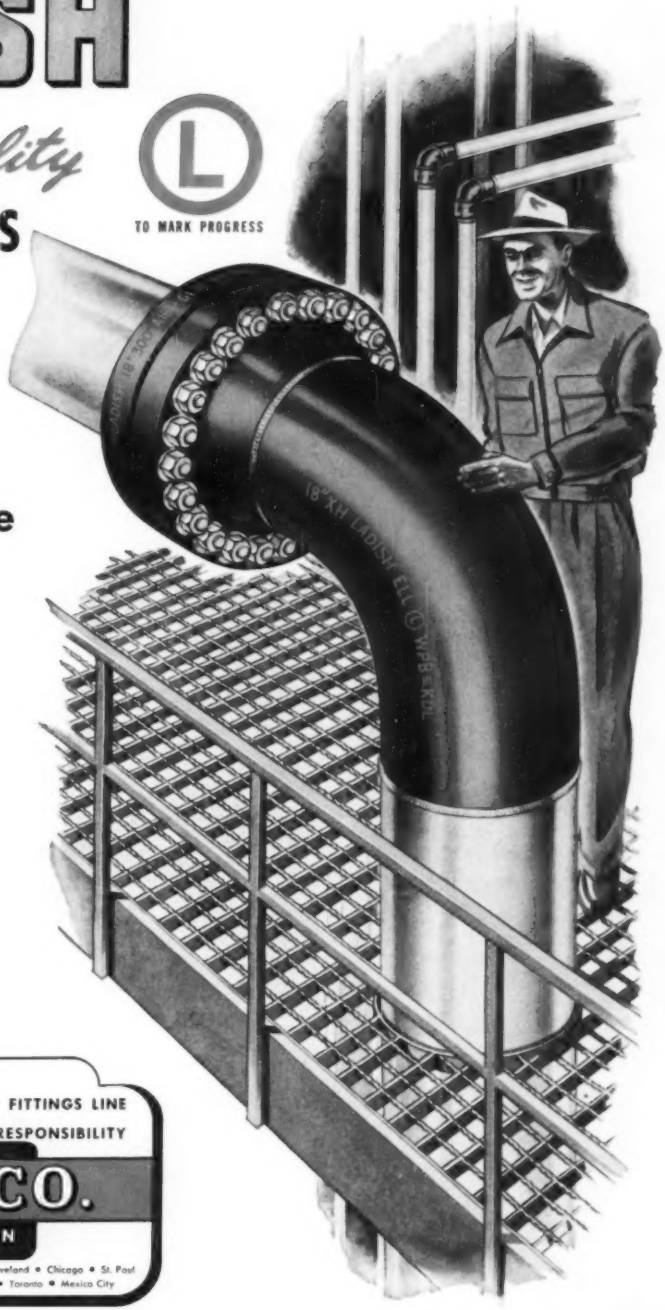
SALES OFFICES • 32nd STREET and SHIELDS AVENUE • CHICAGO 16
FACTORY, LAPORTE, INDIANA

LADISH

Controlled Quality

PIPE FITTINGS

TO MARK PROGRESS



metallurgically sound for maximum service

Sound metallurgy . . . the result of unsurpassed facilities and advanced laboratory controls . . . provides the maximum of dependability in Ladish Controlled Quality fittings. Every phase of metal quality . . . composition, structure and physical properties . . . is continuously safeguarded—and certified proof of metallurgical integrity is available to users of Ladish fittings.

THE COMPLETE *Controlled Quality* FITTINGS LINE
PRODUCED UNDER ONE ROOF...ONE RESPONSIBILITY

LADISH CO.

CUDAHY, WISCONSIN
MILWAUKEE SUBURB

District Offices: New York • Buffalo • Pittsburgh • Philadelphia • Cleveland • Chicago • St. Paul
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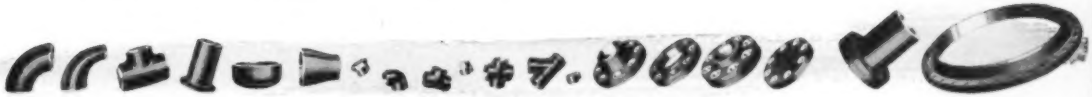


THERE'S A STAYNEW VENTILATION PANEL FILTER

FOR EVERY TYPE OF COMMERCIAL AND INDUSTRIAL SERVICE

Ventilation and air conditioning engineers recognize the Model WKE dry-panel filter as the most efficient unit of its kind on the market today. Wide range of media is available — it operates at maximum efficiency with any medium that comes in sheet form and can be crimped. Because of its extreme versatility, the Staynew WKE filter may be used for hundreds of varied applications.

- Greater filtering area, size for size, than competitive panels.
- Construction permits wide selection of filtering media.
- Wire screen cloth front and back of medium eliminates "sagging" and protects it so that even the most fragile materials can be cleaned over and over again.
- Can be cleaned quicker than any other type panel.
- Can be washed or dry cleaned when necessary.
- Medium can be replaced quicker than in any other panel.

Inexpensive disposable media can be furnished, if desired.

MODEL WKE Dry Panel Filter Available in 2", 4", and 8" Deep Units

One exclusive advantage with the Staynew WKE is that it can be easily vacuum-cleaned in place. Saves time — reduces maintenance costs.

For complete information write today for Bulletin DPF-100.

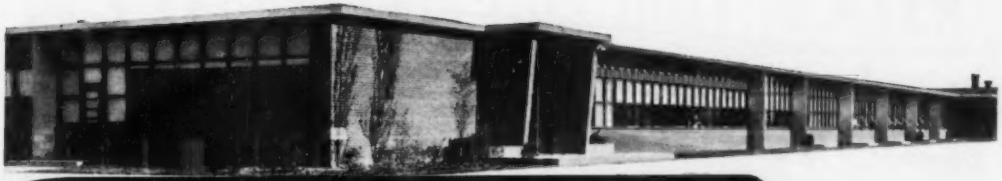
Representatives in Principal Cities

DOLLINGER PROTECTOMOTOR STAYNEW FILTERS

DOLLINGER CORPORATION

9 Centre Pk., Rochester 3, N. Y.

ALL TYPES OF FILTERS FOR EVERY INDUSTRIAL NEED



HERE'S *HOW* AN ARCHITECT BUILT A SCHOOL AROUND THE HEATING AND VENTILATING SYSTEM AND SAVED *30%* ON SYSTEM INSTALLATION

Listed by Underwriters' Laboratories

Approved by American Gas Association

Dravo "COUNTERFLO" Heaters operate automatically, provide constant-temperature fresh air to Hillsborough School.

When the Hillsborough, New Jersey, School was built, architect Jay C. VanNuys specified Dravo "Counterflo" Heaters and built the school *around* the heating and ventilating system, rather than trying to "fit" the system to the school.

Two direct-fired "Counterflo" Heaters, with an output of 1,750,000 Btu per hour each, heat 20,000 cu. ft./min. of fresh filtered air for the 21 rooms of the new school building during the winter months. In warm weather, these same heaters provide comfortable ventilation for the entire school.

The heating and ventilating system is thermostatically controlled and automatic in operation. The unique construction of the school eliminated the need for duct work.

THE RESULTS? The Dravo heater installation at 81¢ per sq. ft. cost 30% less than would a conventional "wet" system; heating and ventilating represented 7% of the total building cost.

Versatile Dravo Heaters can solve many school heating problems.

Dravo "Counterflo" Space Heaters are ideal for heating and ventilating such school facilities as . . . gymnasiums . . . auditoriums . . . stadium rooms . . . libraries . . . cafeterias . . . book stores . . . locker rooms . . . field houses . . . school garages . . . indoor swimming pools . . . manual training shops . . . laundries . . . classrooms.

DRAVO HEATERS OFFER YOU—

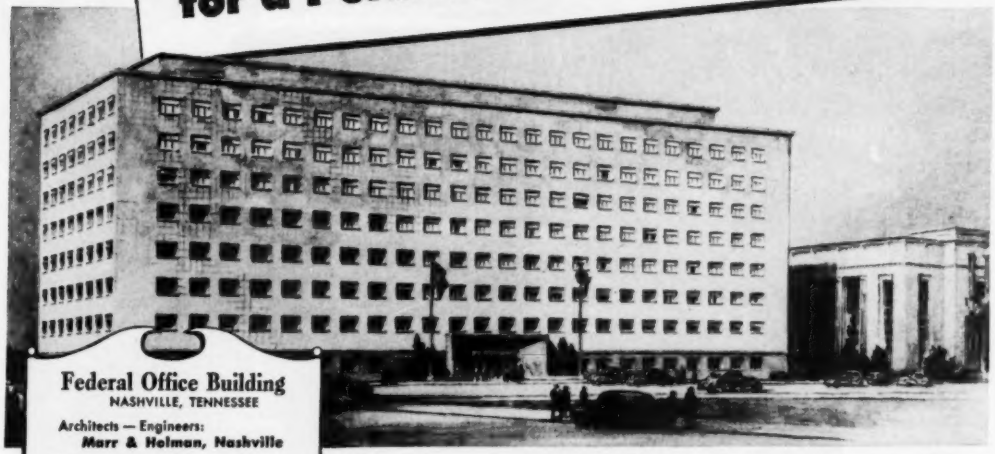
- **Low initial cost . . . users report 30% to 60% savings.**
- **Concentration of heat at working level.**
- **Low Fuel consumption . . . burn gas or oil . . . easily converted.**
- **Automatic Control . . . on-off or modulating controls.**
- **Long service life, low maintenance . . . stainless steel combustion chamber.**
- **Mobility . . . easily moved to any location.**
- **Flexibility . . . where floor space is limited, can be wall-hung or suspended from trusses.**

Planning a school building? Why not look into the possibilities of Dravo "Counterflo" Heaters for your heating and ventilating needs? Write today for Catalog NO—524-57

DRAVO CORPORATION
HEATING DEPARTMENT, DRAVO BUILDING, PITTSBURGH 22, PA.
Sales Representatives in Principal Cities

Manufactured and sold in Canada by Marine Industries, Ltd., Sorel, Quebec
Export Associates: Lynch, Wilde & Co., Washington 9, D.C.

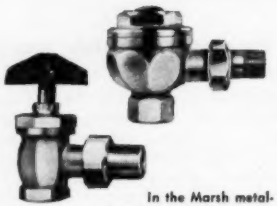
Permanent Valves and Traps for a Permanent Building . . .



Federal Office Building
NASHVILLE, TENNESSEE

Architects — Engineers:
Marr & Holman, Nashville

Plumbing and Air Conditioning Contractors:
J. M. Gallagher Company, Nashville



In the Marsh metal-to-metal seal you have the finest packless valve construction and in the Marsh radiator trap you have the most efficient team-mate for it. This combination was widely used in the Nashville Federal Office Building.

This Marsh float and thermostatic trap is typical of a wide line of Marsh traps for all services. Many are installed at Nashville.

Impressive even in the vast building program of the Public Buildings Administration is this big Federal Office Building at Nashville, Tenn.

Buildings like this are built to function faultlessly, with a minimum maintenance, for a long, long time to come. This is also the distinguishing characteristic of Marsh Heating Specialties. So the choice of Marsh Valves and Traps for this massive structure is entirely logical.

At the right of the illustration you see a part of the stately Nashville Post Office. Erected in the late thirties and also equipped with Marsh Heating Specialties, it stands as another example of a permanent building provided with permanent heating equipment.

Indeed this respect for Marsh quality is demonstrated on a nation-wide scale in the selection and specification of Marsh valves, traps, vents and controls for finer buildings, large and small, in every part of America. Use Marsh equipment on your next job and you will see in its advanced design and trouble-free service why it is the first choice of the most discriminating heating men.

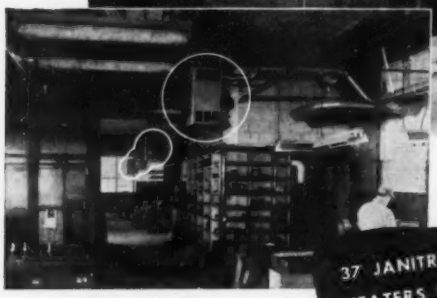
MARSH HEATING EQUIPMENT CO. *Sales affiliate of Jas. P. Marsh Corporation*
Dept. T

BIG FUEL SAVINGS — WITH HEAT REGULATION IN STEP WITH THE WEATHER.
Maximum comfort with minimum heating costs . . . that is what the Marsh-Tritrol accomplishes by controlling heat in step with outside weather. Ask for facts.

MARSH *Heating Specialties* SINCE 1865

IN 3 YEARS THIS GAS UNIT HEATER INSTALLATION WILL PAY FOR ITSELF IN FUEL and LABOR SAVINGS!

Modern plant of Milwaukee Valve Company, Milwaukee, Wisconsin. Manufacturers of Milvaco valves for the plumbing and heating industries.



Series of Janitrol Unit Heaters installed in manufacturing area.

Large blower type Janitrol unit in basement stockroom directs uniform heat through ducts to locker rooms.

By serving the plumbing and heating industries for over 50 years, the Milwaukee Valve Company has wide experience in the problems of this field.

In 1950, they decided to do something about their own heating problems and advancing costs. With the increases of fuel and labor, their total heating operating and maintenance costs were running over $20,000 annually.

In 1950-1951, they converted to Janitrol Gas-Fired Unit Heaters. Now, after a full heating season experience, their savings are approximately $7,000. Three years of these savings will pay for the Janitrol conversion. Similar worthwhile savings are possible in many types and sizes of plants. And, for new construction, why not take advantage of these important dollar savings in the "blueprint stage."

Write for specifications on the complete Janitrol line of Suspended Units, Duct Heaters, Blower-equipped Models and Big Capacity Floor Types.

®Janitrol
GAS FIRED UNIT HEATERS

SURFACE COMBUSTION CORPORATION • TOLEDO 1, OHIO

Wagner
ELECTRIC MOTORS
...the choice of leaders in industry

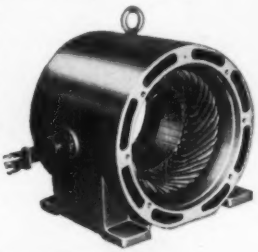
Wagner
Cast Iron Frame MOTORS

Totally-enclosed Fan-cooled

Built for use in corrosive atmospheres

Wagner Cast Iron Frame Motors are designed to provide the corrosion resistance demanded by applications in chemical plants or in other applications where protection against corrosion is required. They feature completely protected laminations . . . special varnish treated windings . . . a cast iron, gasket-sealed conduit box . . . a running shaft seal . . . and are totally-enclosed and fan-cooled for complete protection against acids and alkalies present in the atmosphere in the form of dust, fumes or moisture. The photo at right illustrates the rugged, one piece cast iron frame, showing openings for ventilation.

Where additional protection against explosive atmospheres is desired, an explosion-proof design (type JP) is available. Both the standard (type EP) and the explosion-proof types are built in ratings from 2 to 250 hp., with either normal or high torque characteristics. Non-ventilated 1 and 1½ hp. motors also available. Wagner Bulletin MU-132 gives complete information on these corrosion-resistant motors. Write for your copy today.



®Wagner Electric Corporation
EST. 1891

WAGNER ELECTRIC CORPORATION
6370 Plymouth Ave., St. Louis 14, Mo., U.S.A.

ELECTRIC MOTORS - TRANSFORMERS - INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS — AIR AND HYDRAULIC

BRANCHES IN 32 PRINCIPAL CITIES

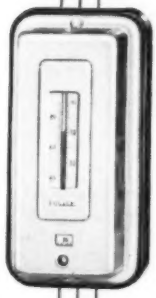
M52-10

POWERS

AIR CONDITIONING
RADIANT HEATING
HOT WATER HEATER

Control

ARCHITECTS: EGGERS & HIGGINS
ENGINEER: GUY B. PANERO
CONTRACTOR: ARTHUR E. MAGHER CO., INC.
(All of New York City)



Used in MEADOWBROOK HOSPITAL

East Meadow, Long Island, N. Y.

Modern Hospital Planning now includes greater attention to the importance of accurate control of air conditions in patients' rooms as well as operating, labor, delivery, nursery, radiograph, cystoscopy, fluoroscopy and anesthesia rooms — which are POWERS controlled at Meadowbrook Hospital.

Greater Comfort of Patients aided by Powers Automatic Temperature Control helps hasten recovery enabling them to return home sooner. Increased turnover enlarges hospital's capacity to serve more people.

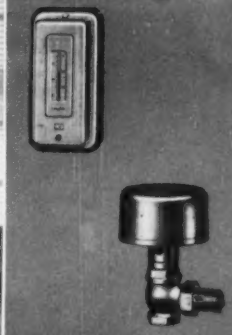
Important Fuel Savings—Much higher fuel costs—a big item of expense—can be substantially reduced by prevention of OVER-heated rooms with Powers Control. Fuel savings alone make it a more profitable investment now than ever before.

15 to 25 Years of Reliable Service with very little for repairs is often reported by users of Powers Control. It is unsurpassed for low operating and maintenance cost.

For the right solution to your control problems call Powers. Take advantage of our many years of experience in supplying temperature and humidity control for all hospital requirements, including hydro-therapy controls.

(n68)

Established in 1891 • **THE POWERS REGULATOR COMPANY** • SKOKIE, ILL. • Offices in Over 50 Cities



Lincoln Elementary School and Classroom, Mt. Prospect, Ill.
Architects & Engineers:
Childs & Smith and T. Maseng & Associates
Contractor: Plonsker Engineering Co.

Some of the Many Installations of

POWERS *Pneumatic Systems of* Temperature Control

In Contemporary Elementary Schools

These five new modern schools and thousands of others represent one of our nation's most valuable assets. Present and future returns on this investment are incalculable.

Maximum returns on the investment in automatic temperature control have been assured by the selection of Powers equipment. Regardless of outside weather, classrooms are held at comfortable temperatures automatically. Teachers and pupils are more efficient in rooms that are not OVER-heated. Also, important fuel savings will pay sizeable dividends year after year.

When you want a temperature control system that usually gives over 25 years of reliable-low-maintenance-cost service consult Powers nearest office. There's no obligation.

Established in 1891 • THE POWERS REGULATOR COMPANY • SKOKIE, ILL. • Offices in Over 50 Cities

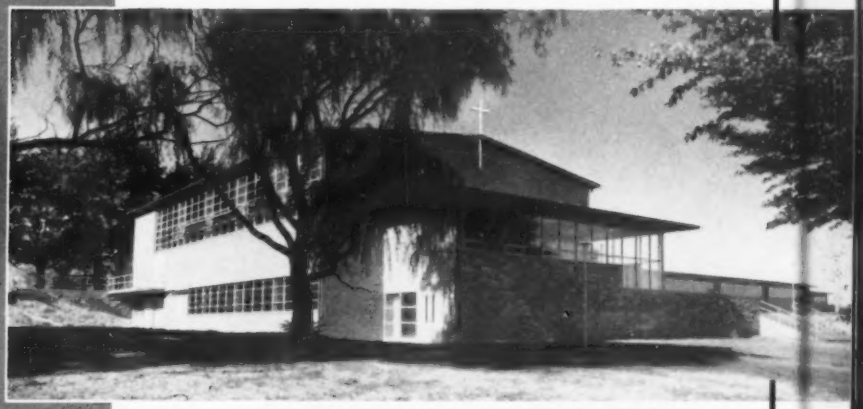
McCandless Elementary School, Hutchinson, Kansas
Architect: McCrackin & Hiett
Engineers: Horwath, Scott & Kinney
Contractor: Stevens, Inc.

Modern Controls
for All Types of
Heating and Ventilating
Systems

(a74)

POWERS

Above: Arno Elementary School, Allen Park (Detroit), Mich.
Architects & Engineers: Eberly M. Smith & Associates, Inc.
Contractor: Page Plumbing & Heating Co.

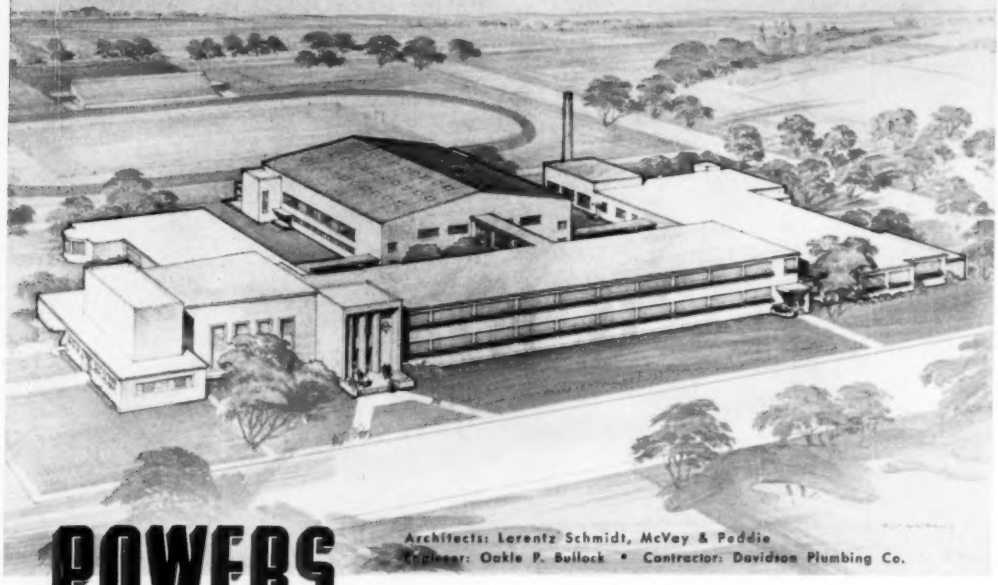


St. Therese of the Child Jesus Parochial School, Philadelphia, Pa.
Architect: James A. Nolen, Jr., Herbert H. Swinburne, Associate
Engineer: A. Ernest D'Ambly • Contractor: Charles J. Williams

POWERS

North Street Elementary School, Rittman, Ohio
Architect: Spahn & Barnes • Engineer: Vincent Eaton
Contractor: Kraus Plumbing & Heating Co.

GREAT BEND KANSAS HIGH SCHOOL EQUIPPED WITH—



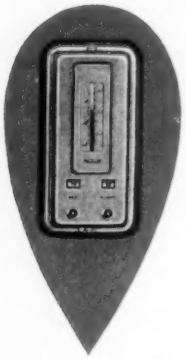
Architects: Lorentz Schmidt, McVay & Poddie
Engineer: Oakle P. Bullock • Contractor: Davidson Plumbing Co.

POWERS

Pneumatic System of

Temperature Control

Assures utmost comfort and efficiency of teachers and pupils — less maintenance — bigger fuel savings.



56 Powers Day-Night Thermostats here control 81 Diaphragm Valves in Unit Ventilators and Convectors.

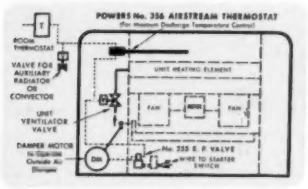
Simplicity and Continuous Dependable Operation of Powers unit ventilator control is due to the design of its Low Limit Airstream Thermostat. Since unit ventilators operate on minimum discharge temperature much of the time the following advantages are important:

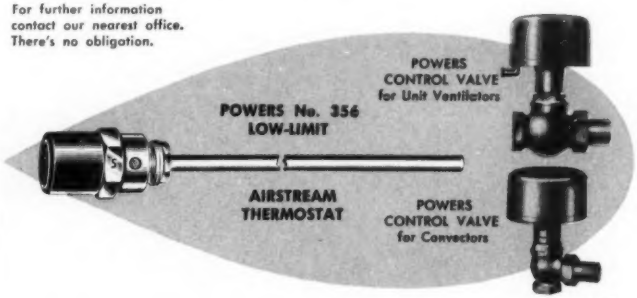
1) Powers 2-line non-waste Airstream Thermostats have a graduated dial for ease of adjustment — also Adjustable Sensitivity for precise control.

2) With its ingenious non-waste double air valve mechanism there is no continuous waste of compressed air. It is not a "leakstat."

3) Once set for the proper temperature a Powers Low Limit Thermostat requires no re-adjustment — there are no fine restrictions to be serviced.

For further information contact our nearest office. There's no obligation.




POWERS CONTROL VALVE for Unit Ventilators
POWERS No. 356 LOW-LIMIT
AIRSTREAM THERMOSTAT
POWERS CONTROL VALVE for Convectors

(a56)

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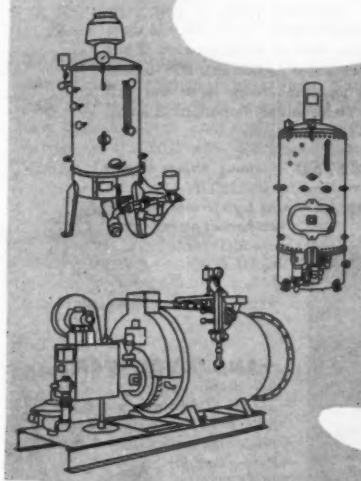
Mr. Heating Contractor: **5 Good "tips" on choosing Eclipse**

McKee **Eclipse** HIGH PRESSURE STEAM BOILERS



1 RIGHT POLICY

Eclipse wants to do business with Heating Contractors, and makes it profitable for YOU.

2 RIGHT PRODUCT

Eclipse has a Complete Line of Boilers, ½ to 100 H.P.; Pressure 15 to 250 Lbs.; Gas-Fired, Oil-Fired or Combination Gas and Oil-Fired; Vertical or Horizontal. McKee-Eclipse "Steamboilerplants" are built better than code; easily installed—and Eclipse stands back of the entire installation.

3 RIGHT REPRESENTATION

Eclipse has Representatives in all principal cities, to help you sell and service.

4 RIGHT REPUTATION

Eclipse has been the leader in its field for more than Forty Years.

5 RIGHT FACILITIES

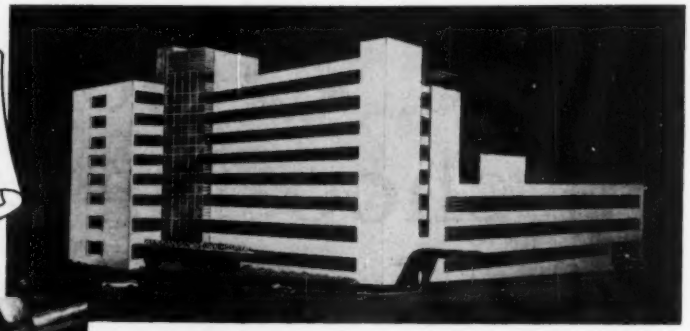
Eclipse has just moved into its brand new modern building, tripling its former floor space. This gives us greatly increased capacity and facilities for Engineering, Building and Delivering still Better Boilers.

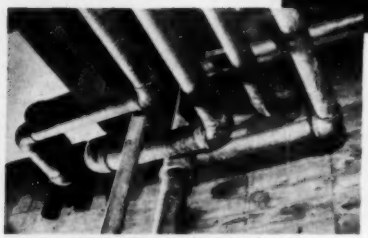
The Most Complete Line of Gas-Fired Industrial Equipment on the Market

Eclipse Fuel Engineering Company
1139 Buchanan Street, Rockford, Illinois
McKee Eclipse

6809

THE NEW
BEEKMAN—DOWNTOWN HOSPITAL
NEW YORK CITY



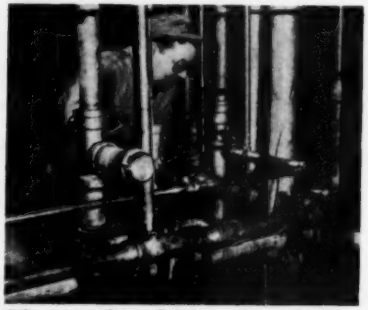


4" and 5" water lines with Flagg face feed fittings.

All Water Piping is brazed with SIL-FOS

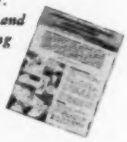
Everything in this hospital now being built in downtown New York City is up-to-the-minute. The water piping is no exception. Type B brass pipe and Flagg face feed fittings are used in both hot and cold water lines — all joined the modern way with SIL-FOS, the low-temperature silver brazing alloy for non-ferrous metals. Because it eliminates threads, brazing permits the use of this pipe, which has 1/3 the wall thickness of standard pipe. This means a tremendous saving in metal and weight.

Pipe sizes in these lines range from ½" to 5". All told there are some 6000 fittings, about half of which are tees. If our math is right, that makes about 15,000 SIL-FOS brazed joints — leak-tight joints that can't work loose and will never need maintenance. That's mighty important in a hospital — or anywhere else for that matter.

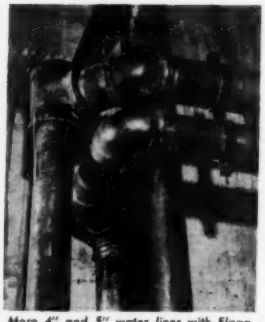


Slide pipe into fittings, flux, heat and apply SIL-FOS — that's the modern way to install non-ferrous pipe and tubing.

***IF YOU'RE INTERESTED** in joining fittings to pipe or tubing, check the Return Card for* BULLETIN 17. *It gives complete instructions for brazing both ferrous and non-ferrous piping with EASY-FLO and SIL-FOS.*



SIL-FOS flows over entire joint area the instant its flow point is reached. Its extreme fluidity promotes capillary action, making it easy to braze joints in any position.



More 4" and 5" water lines with Flagg face feed 45's, elbows and tees.

***—AND IF YOU WANT** full details about EASY-FLO and SIL-FOS brazing, plus helpful dope on joint design and fast production methods, check that Return Card for* BULLETIN 20.

85th Anniversary
HANDY & HARMAN — FOUNDED 1867 — QUALITY SERVICE

HANDY & HARMAN

General Offices: 82 Fulton St., New York 38, N. Y.

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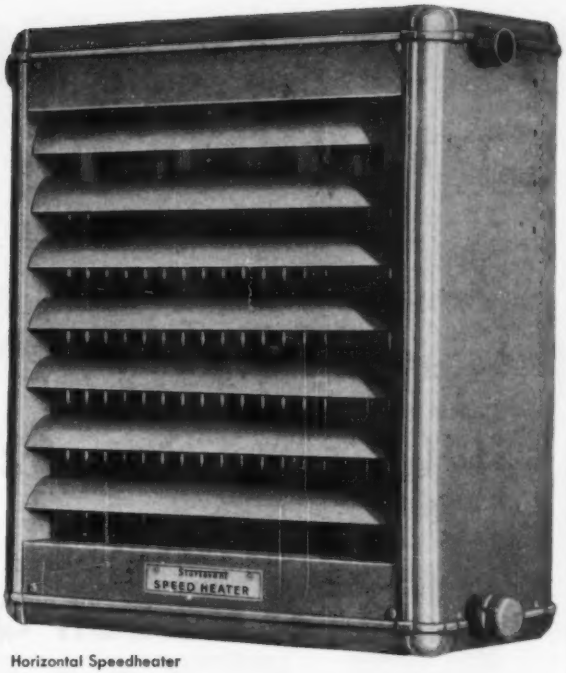
CHECK ALL 5

AND YOU'LL CHOOSE

Westinghouse SPEEDHEATERS®

A pioneer name in Unit Heaters



Horizontal Speedheater

1. ECONOMY. Speedheaters are so compact and efficient that you get fifteen times more heat output per pound of weight than with cast iron radiation. That means substantial savings at the coal pile—plus much lower first cost.

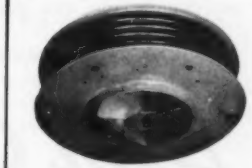
2. UNIFORM HEATING. You can place heat where you want it—uniformly. Warm air *in motion*, forced down instead of permitted to accumulate at the ceiling, eliminates cold spots.

3. QUIETNESS. The design of the Sturtevant fan provides a smooth flow of large volumes of air. There's no vibration, no flutter. Quiet motor and solid construction minimize noise.

4. DEPENDABILITY. The engineered-in, built-in, construction features, such as its heavy gauge steel case and leak-free radiators, plus the dependable Westinghouse motor, give you a Speedheater that can be installed and depended upon.

5. RANGE OF SIZES. Sturtevant Speedheaters are available in 26 sizes and in a variety of models. You can select the right one to match your problem. Types include steam, low temperature, hot water, dairy and textile mill. Capacities range from 25,000 to 400,000 btu.

Contact your local Westinghouse-Sturtevant Speedheater distributor today, or write Westinghouse Electric Corporation, Air Conditioning Division, 164 Damon Street, Hyde Park, Boston 36, Massachusetts.



Downblast Speedheater

TUNE IN ON HISTORY! Only Westinghouse brings you complete coverage of four-month political campaign over CBS television and radio.

YOU CAN BE SURE...IF IT'S

Westinghouse

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NOW! *Pur Air* Gives WRITTEN CERTIFICATION of Carbon Quality

The only positive way to eliminate odor and gas problems is with activated carbon of guaranteed adsorptive qualities. That is why we certify carbon quality. Written certification is based on individual batch tests that guarantee the carbon in your equipment to be full 50-minute, Activated, Coconut-Shell Carbon, based on the grueling, accelerated chlorpicrin test. 15,000 tests prove this to be most effective. Pur Air, being the only manufacturer that both produces Pur Air ACSC* and builds equipment, too, can guarantee results.

*ACSC — full 50-minute, activated, coconut-shell carbon

Pur Air ACSC* equipment is available for installation in duct systems and in self-contained units for taverns, restaurants, offices, storages, etc. Nice thing about all of this is the pay-off economy. You can re-use the same air (without costly cooling or heating). Intake of "off temperature" outside air is reduced. Savings often pay for equipment in a couple of years.

If you have an odor or gas removal problem, call on us for recommendations. There are 77 offices at your service.

Pur Air

— a division of
American Solvent Recovery Corp.
Eighth and Cassady Avenues
Columbus 3, Ohio

Pur Air — a division of American Solvent Recovery Corp.
Dept. HP, Eighth and Cassady Avenues Columbus 3, Ohio

Please send further information about Pur Air equipment.

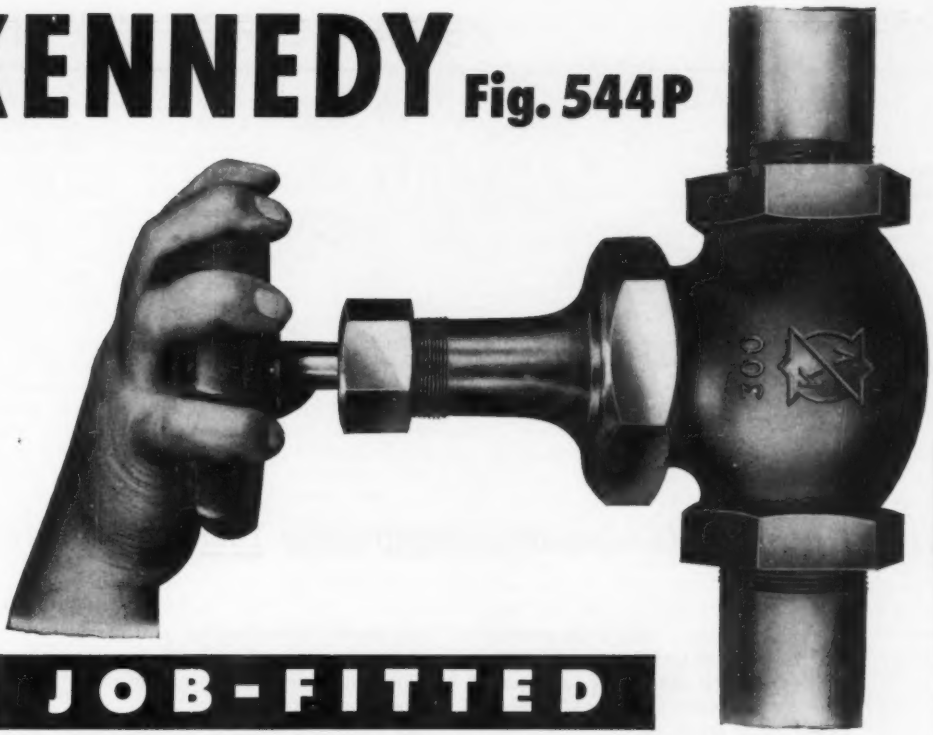
Name_____

Company_____

Address_____

City_____ State_____

KENNEDY Fig. 544P



JOB-FITTED

for longer disc and seat life . . . where accurate control is a must

Like all valves in the complete KENNEDY line these bronze globe valves are JOB-FITTED . . . specially designed and engineered for the job they have to do!

UNION BONNET RING, heavy bronze section with extra thread engagement to assure a tight joint. Union bonnet makes a valve easy to dismantle and reassemble.

STEM, Naval Brass Rod, Acme threads, large diameter with extra thread contact . . . extremely resistant to wear.

PACKING, molded rings of graphited, wire-inserted asbestos designed for high pressure service.

PLUG TYPE DISC, nickel copper alloy, has extra wide seating surfaces for precise throttling control . . . is exceptionally resistant to scouring or wire drawing.

RENEWABLE SEAT RING, nickel copper alloy, ground to match disc in each valve to assure full bearing surfaces over entire contact area of each.

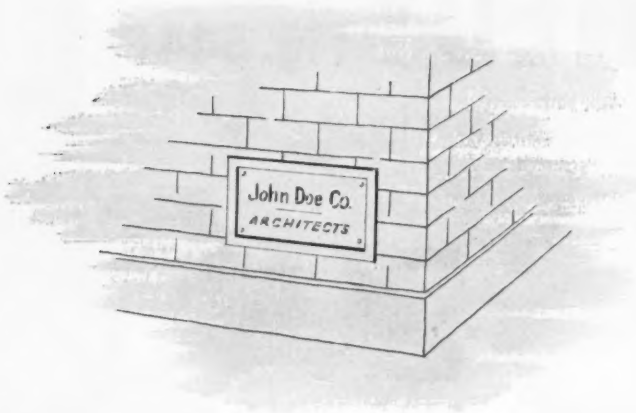
KENNEDY Fig. 544P, plug type disc, and Fig. 544, full-way disc, are designed for 300 lbs. steam, 600 lbs. WOG. Fig. 138P, plug type, and Fig. 138, full-way disc, for 200 lbs. steam, 400 lbs. WOG.

WRITE FOR BULLETIN 108

KENNEDY JOB-FITTED VALVES

THE KENNEDY VALVE MFG. CO.
ELMIRA, NEW YORK

VALVES • PIPE FITTINGS • FIRE HYDRANTS



Is Destructive Condensation Jeopardizing Your Reputation?

SPECIFYING on a "take-it-for-granted" basis, some architects and builders, with their own hands, sow the seeds of destruction inside the walls of buildings they are so proud of.

A sturdy, frame house in Pennsylvania, for example, had to be moved. But it was found that the sills had rotted away. Ordinary insulation inside the walls, with asphalt rather than metallic vapor barriers, had promoted destructive condensation, causing rot and decay.

A large brick and steel apartment development in the suburbs; a huge housing project in a big city; each caused great expense to its sponsors when ordinary insulation inside walls produced condensation, causing peeling paint and crumbling plaster.

Protection of buildings as well as reputations is ensured by the use of non-condensation-forming, zero permeability, waterproof multiple accordion aluminum sheets, which are an exceptional barrier to heat flow.

Pre-fabricated forms of multiple accordion aluminum sheets are now available which automatically create four or six reflective air spaces.

The air spaces eliminate nearly all heat flow by CONDUCTION. The aluminum surfaces throw back 95% to 97% of heat flow by RADIATION. CONVECTION is blocked.

Further information may be found in standard reference manuals or in "Simplified Physics of Vapor and Thermal Insulation" by Alexander Schwartz. Copies may be obtained *free* by mailing the coupon below.

The commercial form of pre-fabricated multiple accordion aluminum insulation is Infra Type 6, 4, and 4 Jr.

THERMAL FACTORS, TYPE 6 INFRA

Up-Heat C.089, R11.23 equals 4⅜" DRY Rockwool
Wall-Heat C.073, R13.69 equals 5⅝" DRY Rockwool
Down Heat C.044, R22.72 equals 9" DRY Rockwool

INFRA INSULATION, Inc., 525 Broadway, New York

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525 B'way, N. Y. C. Dept.(H-10)
Please send FREE "Simplified Physics of Vapor and Thermal Insulation."
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THE EDITOR'S PAGES

WE DISPLAY EACH month, on our contents page, the ABC symbol denoting the membership of Heating, Piping & Air Conditioning in the Audit Bureau of Circulations. . . . Before 1914 there was no generally accepted means of measuring a publication's circulation. There were no standards of circulation values. If a publisher honestly claimed a circulation of 15,000 he might find himself bucking a competitor's claim of 25,000, which by actual count might have been considerably lower. Likewise, advertisers were placed in the predicament of not knowing who read a specific publication. This made it impossible to plan an advertising campaign that would reach and cover specific markets. A group of publishers and advertising men, seeing this mutual need for dependable facts and figures on circulation, formed a cooperative association which they called the Audit Bureau of Circulations. Since that day the Bureau has had its experienced auditors make annual audits of the circulation records of each publisher member. The reports from these audits have been made available to all, enabling a judgment of the publication's worth based on definite standards and values. . . . But where do you, individually, benefit? Naturally, in the editorial content. ABC standardization of circulation techniques is the behind-the-scenes force that makes for editorial quality. The ABC audit shows us you pay to read what we have to say. It also shows us when we cease to serve you effectively. This constant check of your interest keeps us on our editorial toes. In short, we have a contract with our subscribers to deliver a *specific* number of issues of a *specific* editorial character for a *specific* length of time at a *specific* price. We ask you, "Do we stay in business?" Our very existence depends on your continued acceptance. We *must* help and interest you in order to do business.

SHORT COURSE SPEAKER DEFINES GOOD HEATING

R. E. MOORE, vice president and secretary of the Bell & Gossett Co., defined a good heating job as one which results in the "utter absence of a feeling of being hot or cold" on the part of the occupants. The same definition also applies to summer cooling, he said.

Speaking at the banquet session of the sixth short course in hot water and steam heating, held last month at the University of Illinois, Urbana, Mr. Moore "stuck his neck out" and made a few predictions for the future — among them being the greatly increased use of snow melting for sidewalks and driveways. He thought that the life insurance companies might well be interested in promoting the idea of "let the fuel man shovel your snow."

He believes also that there are interesting possibilities in the resetting of thermostats in individual buildings, in accordance with the outdoor temperature, by radio waves from a central point (such as the Weather Bureau.)

He predicted also the use of higher water temperatures (400 deg and up) for process and space heating applications.

A possibility of interest — and which he intends to pursue further — is the installation of automatically fired heating boilers for small buildings in waterproofed excavations "out in the backyard." There might be several advantages to such a scheme, including possible reductions in fire insurance rates, he said.

In concluding his talk, Mr. Moore said that "the fellow who knows 'how' will always have a job, and the fellow who knows 'why' will always be his boss." Our entire future lies ahead of us, he pointed out, and he called upon his audience to use imagination in the further development of heating methods and their application.

The short course was presented by the university in cooperation with the Institute of Boiler and Radiator Manufacturers, which has sponsored a great deal of research at Urbana on hot water and steam heating. Attendance at the three days of sessions — held mostly in air conditioned Gregory Hall — numbered about 150.

MART TO HAVE 6800 TONS FOR AIR CONDITIONING

A CONTRACT FOR equipment to air condition an additional 400,000 sq ft of the famous Merchandise Mart has been placed, according to William S. Bodinus, Chicago district manager for Carrier Corp., and with its completion, the Mart "will have more air conditioned space than any

"QUOTE"

"There will be a profound change in the engineering profession in the next quarter century.

"This will come about largely because the need for engineers will rise at a more rapid rate than the supply. Technological processes in almost all fields are becoming more complex. This alone calls for a larger annual output of engineers.

"Peacetime needs for engineering services are accelerating. The amount of engineering required per unit of population continues to increase while the supply of engineers is likely to remain fixed.

"An adjustment seems inevitable to accomplish the engineering work that must be done by the limited number of engineers available. This adjustment lies in the direction of better utilization of engineers. To a considerable degree, engineers have been used for subprofessional work. In fact, some are not trained to perform functions much above the subprofessional level. It will be increasingly necessary to use engineering aides to extend the service of the engineer in much the same way that therapists, nurses and laboratory technicians are used to extend the doctor's services."—*Dean Solomon C. Hollister, of the Cornell University College of Engineering, at a dinner meeting of the Cornell Society of Engineers held in Chicago during the Centennial of Engineering.*

other commercial building in the world," he said. "It is exceeded in this respect only by one military building — the Pentagon in Washington."

The new contract provides for 1100 tons of cooling capacity, to be provided by a centrifugal machine which will take its place alongside six other machines installed previously in the basement of the world's largest commercial building. With this addition, about 2.4 million sq ft of the building's 3 million sq ft of rentable space will be provided with year 'round air conditioning.

"The Merchandise Mart's air conditioning has been installed progressively over the past two decades," Mr. Bodinus pointed out. "The first 200 tons of air conditioning went into the building in 1930 for the National Broadcasting Co. studios there. At intervals since that time varying amounts of additional cooling capacity have been added. Because of advance planning, all of the subsequent additions have been able to tie into the chilled water system originally installed."

The current order is the largest in dollar value and brings the total capacity of the air conditioning system to 6800 tons, he said.

The Merchandise Mart, with a daytime population close to 25,000 people, was one of the first large buildings to use air conditioning.

HAS "TYPICAL" WOMAN ENGINEER'S JOB

A "TYPICAL JOB" for a woman engineer is that of Beatrice A. Hicks, vice president and chief engineer of Newark Controls, according to the Chicago Daily News' story on the Society of Women Engineers meeting held last month in conjunction with the Centennial of Engineering observance. Just 14 years after finishing engineering school, Miss Hicks — who is "tall, feminine and fashionable" — is in charge of 30 employees who design controls for heating systems, said the News.

Margaret Ingels, who is engineering editor, Carrier Corp., was a featured speaker at the meeting — her subject being Petticoats and Slide Rules. Widely known in the air conditioning, heating and ventilating fields, she is the author of a number of articles and papers (some of which have appeared in HPAC.) She has been working in recent months on memoirs of the late Dr. Willis H. Carrier.

Miss Ingels is the first woman to graduate from the University of Kentucky's college of engineering.

A.C. A POPULAR CONVERSATION TOPIC

THE PAST SUMMER'S heat waves, the air conditioned and widely televised political conventions, and the general growth of air conditioning applications in home, office and industry all combined to make air conditioning a rather general topic of public attention this year.

Typical, perhaps, was a cartoon by Wortman in the New York World Telegram and other newspapers. The drawing showed a beach scene, with one bather saying to another, "Next year I'm not going to take my vacation in July or August. I'm going to stay in the office and get some of that good air conditioning."

OIL HEATING PIONEER DIES

WILLIAM R. RAY, 73, who was chairman of the board of directors of the General Controls Co. at the time of his recent death, was involved in development of the horizontal rotary oil burner, the dual pump and reservoir and many other improvements in the combustion, automatic controls, heating and connecting fields. His original oil burner model is on exhibition at the Smithsonian Institute, in Washington.

Mr. Ray was a self-made engineer who never finished high school, yet his self-education and study resulted in his securing over 20 patents in the oil heating, combustion and cooking fields. Mr. Ray sold his oil burner company in 1929 and retired, but in the following year he assisted his two eldest sons, William A. and Charles, in forming the General Controls Co.

NEW AIRCRAFT CARRIER AIR CONDITIONED

THE LARGEST air conditioning installation ever to be made in a combat ship of the United States Navy has been contracted for to provide the air conditioning and refrigeration equipment for the world's greatest aircraft carrier, the U.S.S. Forrestal, according to William Bynum, executive vice president of the Carrier Corp., in announcing a contract with the Newport News Shipbuilding and Dry Dock Co. The contract, amounting to more than $300,000, calls for six 150 ton centrifugal refrigerating machines for air conditioning the entire ship, including living quarters as well as control and operating compartments.

"Reflecting the studies of the Navy on the environment and physiological effects of air conditioning on ships' personnel, the equipment will be made an integral part of the Forrestal installation as a means of contributing to its fullest efficiency in combat under modern warfare conditions as well as in peacetime maneuvers," Mr. Bynum said.

ANNOUNCES STUDY OF POST-DEFENSE MARKETS

SECRETARY OF COMMERCE Charles Sawyer announced recently the formation of an advisory committee of nineteen outstanding business economists to serve in connection with a study of post-defense markets which the Department of Commerce has undertaken in cooperation with the Committee for Economic Development.

"Keeping the amazing productive capacity of the United States at work after the present defense build-up has been completed will be the job of private enterprise," Secretary Sawyer said. "To do that job well, businessmen will need authentic information on the potential markets for goods and services which will be available or may be developed for a civilian peacetime economy. The Department of Commerce study is designed to provide such information and the advisory committee I have named will help insure that the study will be useful and practical. The study will be published by January 1, 1953 so as to provide adequate time to assist business in preparing for potential markets which may be utilized at such later time as defense production has leveled off from its peak."

+ +

Keep cool: Tests conducted by a large midwestern university showed that students suffered an average drop in mental efficiency of 40 percent during the hot and humid summer months, according to the air conditioning division of Mitchell Mfg. Co.

St. Francis Hospital, Trenton, N. J. The new $3,000,000 8-story addition, shown at left, is now under construction. Architects and Engineers: Schmidt, Garden & Erikson, Chicago. Heating Contractor: Wm. F. Hindley Co., Trenton. Operation of St. Francis Hospital is under the direction of the Sisters of the Third Order of St. Francis.

MEET HOSPITAL REQUIREMENTS

with Modern Controlled Steam Heating

Balanced Heating . . . Outdoor Thermostat Control . . . Continuous Steam Flow . . . First applied to modernize older buildings . . . Now being installed in new addition.

Schmidt, Garden & Erikson, Chicago Architects and Engineers noted for their hospital work, are the creators of the completely modern addition now being erected alongside the older buildings of famed St. Francis Hospital, Trenton, New Jersey. This new addition will have modern controlled steam heating incorporating the proven principles adopted in modernizing the original vacuum heating installation in the existing buildings.

The three original buildings, the most recent completed in 1927, were overheated, indicating fuel waste and involving considerable maintenance. In 1949 the original system was changed to a Webster Electronic Moderator System by John G. Carr Co., Inc., Trenton heating contractor.

Reporting results, Chief Engineer A. P. Scharer said that the modernization was paid for out of fuel oil savings in less than two years. Further, these older buildings are comfortably heated, with a noticeable absence of overheating in mild weather.

Is your hospital in need of modernization? It will cost you nothing to investigate. There are Webster representatives in 65 cities experienced in working with owners, architects, engineers and heating contractors in the solution of specific heating problems. Ask to see your Webster Representative.

Address Dept. HP-10

WARREN WEBSTER & COMPANY

Camden 5, N. J. Representatives in Principal U. S. Cities

In Canada, Darling Brothers, Limited, Montreal

WEBSTER

MODERATOR

SYSTEM

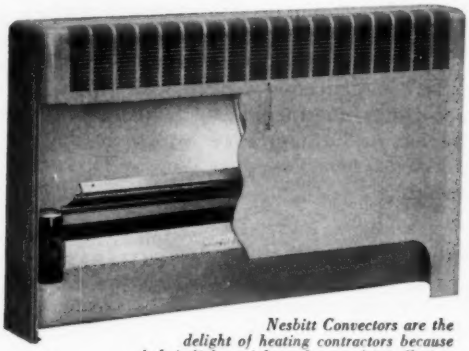
OF STEAM HEATING

"Controlled by the weather"

How many of these *advantages* do you get in the *convectors* YOU buy?

Model U Convectors provide clean, uniform heat as well as comfortable radiation.

You get all these in NESBITT Model U Convectors



Nesbitt Convectors are the delight of heating contractors because of their light weight and ease of installation.

Scientific design: an *engineered* product resulting from 40 years of Nesbitt *pionairing* in the comfort heating field. ☐

Superior construction: of heavier than customary furniture steel; sturdily reinforced; built up to a reputation, not down to a price. ☐

Artistic styling: conformable to the best décor; rounded edges; functional curved-top grille for added heating capacity. ☐

Pleasing finish: phosphated metal, hardcoated in a neutral prime gray that takes a color coat well, but does not require it. ☐

Universal application: to one or two-pipe hot water systems (forced or gravity), or to two-pipe steam systems. ☐

Optional placement: the one casing may be installed free-standing or semi-recessed, as desired, with front easily removable. ☐

Easy connection: with universal headers tapped for every practicable hookup without removal of element from casing. ☐

Stock sizes: modular lengths in two heights, offering 23 standard sizes—from wholesaler stock—for practically every requirement. ☐

Honest ratings: in generous conformance with Commercial Standard 140-47 and approved by the Convector Rating Committee. ☐

Individual packing: fully assembled in a durable corrugated carton for delivery to the job in mint condition. ☐

Dampers optional: in complete separate packages, with all attachments, for easy installation, originally or later. ☐

Competitive prices: with the savings of large-volume, production-line manufacture passed on to you. ☐

Reliable guarantee: against original defects in material or workmanship, for one year from date of shipment. ☐

Order Convectors *by name:* NESBITT

Sold exclusively through Plumbing and Heating Wholesalers

A product of JOHN J. NESBITT, INC., State Road and Rhawn Street, Philadelphia 36, Penna.

"OPEN FOR DISCUSSION"

We follow here each month the practice at engineering society meetings of providing an "open for discussion" period. You are urged to participate. Address your comments to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.

ALCOA BUILDING'S DUCT SYSTEM SIMPLIFIED

THERE ARE A couple of additional points about the radiant heating and cooling installation in the new Alcoa building — which was described in an article in the September HPAC — which are of interest.

The ceiling panels and the piping systems supplying them are "zoned" into outside sections with the various directions of exposure, and an inside section. This makes it possible to eliminate all zoning from the ducts delivering the supply air (which handles the other 50 percent, approximately, of the summer cooling). This simplification of the duct system — as well as the reduction in the quantity of air — not only effected a large saving in the amount of sheet metal, fans, etc., but also reduced the space requirements for ductwork to a point where (quite literally) the use of radiant cooling has made it possible to thoroughly air condition the building with no increase whatever in the floor-to-floor height.

The bulk of the lighting is done by recessed fluorescent troffers, which are clipped on to the cooling pipes of the grids (the same as the ceiling panels are clipped on) so that the cooling water absorbs a large part of the heat given out by lights, directly at the fixture. This further reduces the cooling effect needed in the room itself, and thus the air quantities.

Another interesting point is that in this building, the cooling water piping for each floor, connecting to the ceiling panels and lighting fixtures, is a *separate* recirculating system. The water in each such system is either cooled or heated (as the season may require). Chilled water from the main refrigerating unit in the basement does the cooling by means of local heat exchangers on each floor, and hot water pump-circulated from the basement does the heating in a similar manner. This arrangement — plus the zoning previously referred to — makes it simple and entirely practicable to heat one side of the building (exposed to a strong wind and no sunshine) and at the same time to cool the other side of the building (exposed to sun and no wind) during the considerable periods of mild spring and fall weather, when this is the best way to secure complete comfort for all occupants. This advantage is gained by the fact that the radiant ceiling panels can either heat or cool, independently of the air temperature being supplied by the ventilating system.

In the article in the September HPAC, it was stated (toward the end) that the specifications called for approximately 30 percent relative humidity, when the outside temperature is 95 deg. This figure should have been given as 45 percent. To attempt to maintain 30 percent indoors would be very extravagant, as it would entail a great increase in the required refrigeration to bring the dew point of the air that low.— ALFRED L. JAROS, JR., Jaros, Baum & Bolles, Consulting Engineers (mechanical consulting engineers for the Alcoa building).

ELECTROSTATIC FILTERS AT GATEWAY CENTER

THE ARTICLE in the September HPAC on the air conditioning of three of the buildings at the Gateway Center development, in Pittsburgh, mentioned that there are 30 sets of electrostatic filters. The correct number is 24.—H. E. MEEKER, Meyer, Strong and Jones, Consulting Engineers.

DETAILS OF SCHOOL HEATING QUESTIONED

I HAVE READ WITH interest the article published in the August HPAC, entitled Heating and Ventilating Chicago's Hale Branch School, by Joseph L. Fatz, Jr., and wish to offer the following comments.

1) The design condition, as per the Chicago school code, of 70 F and 40 percent relative humidity would appear to be unobtainable in the type of construction illustrated in this article. Data in the 1952 edition of the ASHVE Guide gives a recommended outside design condition of −10 deg F and an average winter outside temperature of 37.6 deg F. Fig. 6 in Chapt. 9 of the Guide also indicates the highest permissible relative humidity (inside) for varying outside temperatures, at which condensation will occur on the interior surfaces. With single glass windows and −10 deg outside, the maximum inside relative humidity would be approximately 11 percent. In order to maintain the specified inside relative humidities it would be necessary to have a U value of 0.53 for windows and walls — otherwise, condensation would occur on the interior surfaces.

2) The boiler room plan accompanying Mr. Fatz' article indicates two 275 gal fuel oil tanks at the front of the boiler. If the plan as illustrated is in scale, it would appear that the tanks do not meet the National Board of Fire Underwriters recommendations for a minimum distance between tanks and burner of 7 ft, 0 in. (NBFU Pamphlet No. 31, Par. 8).

3) The boiler room plan also indicates a 5 x 3 x 5 tee, which is not in accord with good practice. A 5 x 5 x 5 tee should have been used, with eccentric reducers to prevent condensate pockets at points of reduction in the main size. The 5 x 3 reducer indicated should also be of the eccentric type.

4) The boiler hookup as shown is not in accord with good practice, inasmuch as the main boiler outlet goes directly into the distribution system — whereas it is customary to provide an equalizer and drip connection from the outlet, and thence into the distribution system.— RUTHERFORD L. STINARD, Consulting Engineer.

REPLY BY AUTHOR — In answer to Mr. Stinard's comments on my article, I wish to offer the following explanations:

1) The humidity in the classrooms varies with the outside temperature, 40 percent being the maximum the

equipment must maintain. However, a higher relative humidity may be maintained and is maintained in our classrooms under the lowest outside design conditions because of the following facts:

A) The *U* value for the walls, as calculated, is approximately 0.44.
B) The chart referred to in the ASHVE Guide assumes a condition of still air on the inside surface and with the type of ventilating equipment installed this assumption is invalid.

2) The Board of Education is a self-insuring body and has its own standards, which in this case is 5 ft, 0 in.

3) The tee was selected as a 5 x 3 x 5 tee in order to guide the condensate to the drip pocket on that steam leg which was designed to handle the condensate. The 5 x 3 reducer is of the eccentric type (specified in the specifications).

4) The drip connection is explained in (3) and because the vacuum return line pump is used as a boiler feed pump and there is only one boiler, an equalizer connection is unnecessary.—JOSEPH L. FATZ, JR., Chicago Board of Education.

MODULATING HEAT OUTPUT OF BASEBOARD SYSTEM

WHERE A modulating room thermostat is controlling a three-way valve in the hot water supply line to a convector or baseboard heating system, the valve will work fine and modulate over 100 percent of the range from open to closed (to hot boiler water circulation) but it turns out that the characteristics of the heating system itself are working against you.

The case in question is a hot water boiler operating at 210 deg and the radiator zone designed on the basis of a 20 deg drop. It was found that when the room thermostat calls for the valve to be opened ⅛, the heat output from the baseboard, instead of being 12½ percent of capacity as you might at first glance be assumed to be right, is actually about 45 percent of capacity. If the valve opens to ¼, the capacity output jumps to about 65 percent.

Since the valve will open ¼ on a ½ deg temperature change, it was discovered that it was actually operating almost like a two position valve, overshooting and undershooting.

I couldn't see why this should happen, so I made some calculations and the accompanying graph of the operating characteristics of the system and came up with the startling results shown therein, which checked closely with the actual operating conditions.

It was found that when the valve was opened ⅛ to the flow of 210 deg boiler water, the water temperature circulating eventually reached 140 deg, which according to the baseboard manufacturer's ratings as shown on the graph are roughly 45 percent of its output capacity based on 200 deg average water temperature. The initial temperature, when the valve was first opened, of course was only 90 deg, which is the 12½ percent capacity output that I had expected to see. This was the result of mixing one part of boiler water (210 deg) and seven parts of cool water standing in the pipes (75 deg). However, the water temperature continued to climb until it reached the 140 deg and then would not go any higher.

The reason, I think, for this unforeseen phenomenon lies in the fact that the system itself had to reach an equilibrium between the heat being added to the system by the boiler and the amount of heat being dissipated by the radiation.

Initially, there was a pickup of 15 deg when the 210 deg boiler water was added to the 75 deg return water from the system, but as the return water temperature rose to 131 deg, the pickup decreased to 9 deg, or an outgoing temperature of 140 deg.

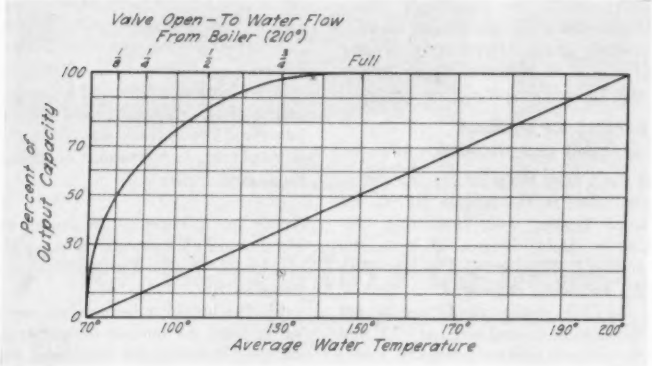
Inversely, the radiation being fed the 90 deg mixed water at the initial opening of the valve developed only 12½ percent of capacity which, on a system operating on a 20 deg drop at designed conditions, amounted to only a 2½ deg temperature drop. As the water temperature rose to 140 deg, the radiator output capacity increased to 45 percent, which on a system with a designed 20 deg drop amounted to a 9 deg temperature drop through the system.

At this point the valve and the system reached a point of equilibrium and there was no further rise in temperature. This will also occur if the valve is fully open to begin with, except that the temperature will continue to drop until equilibrium is reached. However interesting as it was to discover the reason why the system acted this way, it was discouraging to find that by opening the valve only 12½ percent, the system developed 45 percent of its capacity.

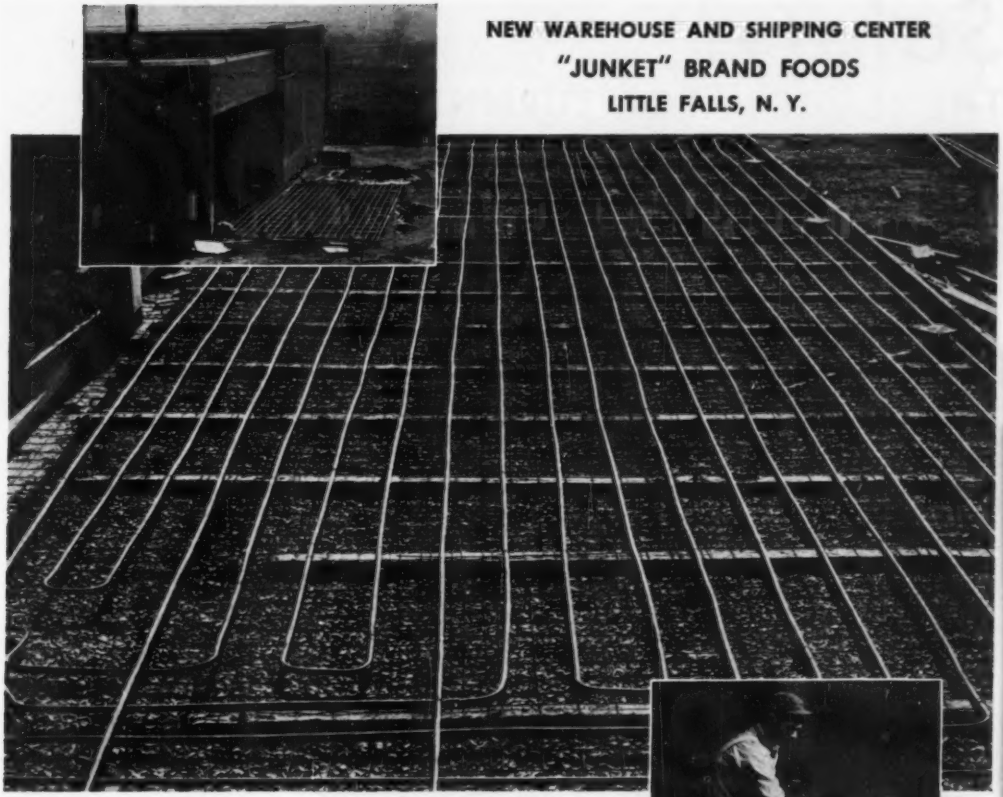
So you see, the valve and thermostat were working fine. It's a matter of system characteristics to be taken into account.

There is a remedy for this, of course, in order to get true modulation — a method which I will hereafter use. That is to install a sensing element in the supply line from the three-way valve and have this instrument control the three-way valve. The room thermostat would then reset the control point temperature of the sensing element in the hot water line, to obtain true modulation.—WILLIAM M. VALENTINE, Consulting Heating and Ventilating Engineer.

OPERATING CHARACTERISTICS of a baseboard heating system, as plotted by Mr. Valentine. Valve output curve is at left, baseboard output curve at right



NEW WAREHOUSE AND SHIPPING CENTER
"JUNKET" BRAND FOODS
LITTLE FALLS, N. Y.



ANOTHER CASE OF *Copper* WHERE IT COUNTS!

During the winter months there will be no snow or ice troubles at the truck entrance of the new "Junket" Brand Foods Warehouse. A snow-melting system of Revere Copper Water Tube in the 20′ x 60′ concrete slab sees to that. This building was designed by Architects, Bagg and Newkirk. Heating Contractor was H. J. Brandeles Corp. Revere Copper Water Tube was supplied by the Crane Co., all of Utica, N. Y.

The contractor found the light-weight, 60′ length coils of Revere Copper Water Tube easy to handle and install. Also, its soft temper permitted bending, reducing the number of fittings used. Other features that architects, contractors and builders like about Revere Copper Water Tube are: Because it is non-rusting it will last indefinitely . . . the solder or compression fittings used make it possible to use a thinner wall tube than is possible when threaded fittings are used, with a substantial saving in metal.

Now, with restrictions eased, and quantities permissible without allotments greatly increased, there isn't any reason why your next job can't have the many lasting benefits of Revere Copper Water Tube for hot and cold water lines, radiant panel heating, underground service lines, processing lines, and waste stack and vent lines. See the Revere Distributor nearest you today. And, if you have technical problems, he will put you in touch with Revere's Technical Advisory Service.

GUIDE PLANK is used by workman to facilitate installation of 1" Type K soft temper Revere Copper Water Tube. Revere Tube also comes in hard and soft tempers in straight lengths of 20 ft.

LARGE PHOTO ABOVE shows Revere Copper Water Tube in place ready for pouring concrete.

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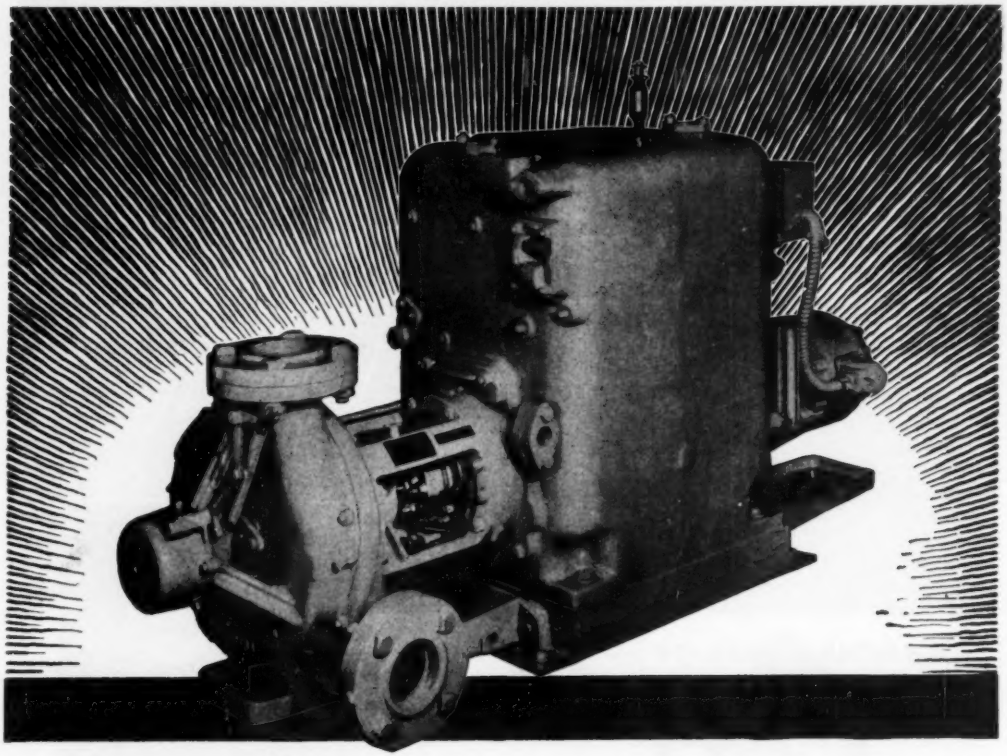
THE NASH VAPOR TURBINE HEATING PUMP IS NOT STOPPED BY ELECTRIC CURRENT FAILURE



For service in greenhouses, hospitals, schools, theatres, and public buildings, where heat failure is a serious matter, the Nash Vapor Turbine Return Line Vacuum Heating pump should be specified, for this pump operates perfectly without electric current.

This is because the motive power is a special turbine operating on steam direct from the heating system. Steam used to drive the Vapor Turbine is returned to the system for heating, with little heat loss.

This pump insures constant heat in the system, it eliminates electric current cost, and it promotes high efficiency in the heating system. Heating efficiency is due to the fact that this pump can operate continuously with economy. Continuous operation means uniform circulation, and uniform conditions in the system mean steam saving.

This pump has but one moving part, no internal wearing parts, and requires no internal lubrication. Bulletin D-246 tells all about it, and it is free on request.

THE NASH ENGINEERING COMPANY

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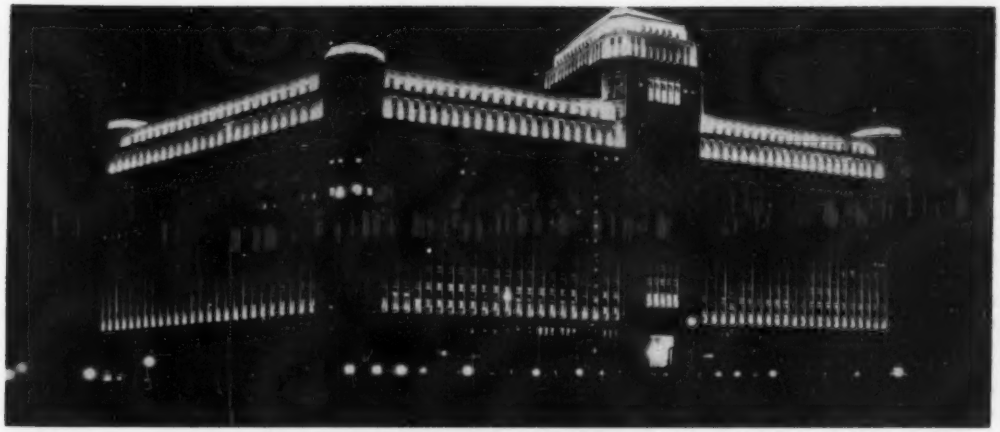


IN LARGER BUILDINGS, the tendency is apparently to pay more attention to heating controls, hours of operation, and economical fuel and ash handling, says the author — thus reducing the cost of heating per sq ft of rentable area

What's the Operating Cost?

Here are some figures on heating, ventilating and air conditioning to answer this question, together with suggestions for keeping track of costs and a few hints on cutting them

By Walter A. Stahl
Operating Manager
The Merchandise Mart

IN CHECKING OPERATING costs for the heating, ventilating and air conditioning services in office buildings, one finds a wide variation in the figures. Much of it is due to different methods of accounting, as some of the items entering into such costs are overlapping and can be included in one expense item or another. Also, the unit of measurement used by both buildings and contractors varies considerably. Some figure costs per ton of refrigeration, while others use costs per 1000 cfm or per sq ft of floor area or rentable floor area. It seems logical that, since office building space is rented on a cost per sq ft basis, that all operating costs should be reduced to this common denominator.

Heating Costs for Buildings Vary

Data published by the National Association of Building Owners and Managers, based on actual records from over 40 office buildings in Chicago, show a heating cost of 16.9c per sq ft of rentable area, and an air conditioning and ventilating cost of 5.3c. According to these figures, the cost of heating accounts for about 10 percent of the total operating expense (not including fixed charges.)

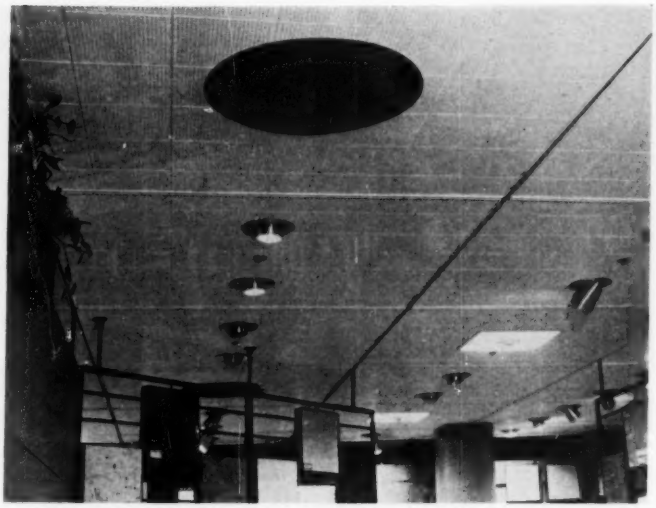
In checking further the cost of heating, there is found to be a considerable variation in the figure for the buildings throughout the "Loop". A building such as the Merchandise Mart, where the exposed wall area is small as compared to the volume of the building, shows a total cost for the heating system of only 6c per sq ft of rentable area per year. This cost is also favorably influenced by the fact that fuel can be delivered by carload. Another building of approximately 1 million sq ft reported a cost of 9½c per sq ft. Apparently, the tendency is that in the larger buildings, more attention has been

given to heating controls, the scheduling of hours of operation and the more economical handling of fuels, ashes, etc.

Accounting Methods Affect Ventilation Cost

The operating cost of ventilation in a large structure such as the Mart amounts to 5c per sq ft. Here, again, there is considerable variation in accounting methods in different buildings. Some consider such areas as toilet rooms or warehouse space with exhaust ventilation only as ventilated area. Properly speaking, in my opinion ventilated areas should include only spaces having adequate supply of both fresh air, and exhaust.

There is also an overlapping of costs between the heating and/or ventilation of a building. In many cases, approximately one-half of the steam generated is used in the heating of air supplied through the ventilation system.



LIFE EXPECTANCY of air conditioning equipment is affected by obsolescence. For example, one would probably not install the same air outlets today as were used 10 years ago, the author points out. This photo shows a recent installation at the Mart

Cost of Adding Air Conditioning

The addition of air conditioning in spaces adequately ventilated, we find, will just about double the cost of ventilation. Thus, in a large structure such as the Mart, where ventilating costs are 5c per sq ft, the operating cost of air conditioning the same area is only 10c per sq ft — not including heating.

There is also a comparable situation in regard to capital expense; if a building is already ventilated, the addition of air conditioning naturally requires a much lower capital expenditure than would be required to air condition an unventilated structure.

In most cases, the owning cost of air conditioning will exceed the operating cost. Installation costs for a complete air conditioning system in this territory might vary from $1.75 per sq ft to $4.00.

The depreciation rate set by the internal revenue department on air conditioning equipment is 6-2/3 percent on a 15 year basis, so that at the lower installation cost of $1.75 per sq ft, this amounts to about 11c per sq ft per year. At an installation cost of $4.00 per sq ft, this becomes about 25c per sq ft per year.

The 15 year depreciation rate is regarded as too short by manufacturers of heavy equipment such as centrifugal machines, where the life should be considerably longer. This would also apply to such items as chilled water piping. However, when we consider coils, air outlets and similar items, the life expectancy is often much less — especially considering the obsolescence factor. For example, one would probably not install the same outlets today as were installed 10 years ago.

Operating and owning costs for air conditioning in Chicago, therefore, seem to vary between a low of 21c per sq ft per year where there are many favorable factors (such as the availability of river water for cooling) and 50c per sq ft in other locations, where the factors are not favorable.

Bigger Lighting Loads Require Conditioning

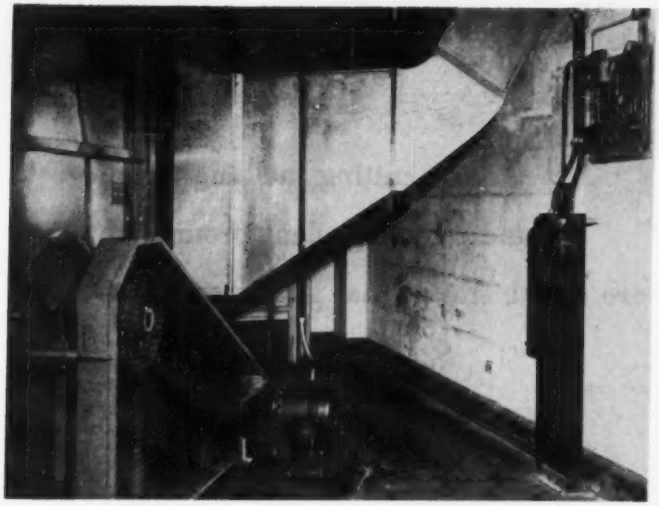
The selling price of the air conditioning service to tenants varies all the way from 25c per sq ft a year to 75c. In considering that the expense of operating an office building in Chicago is around $2.30 per sq ft, it would appear that the addition of air conditioning is quite justified — especially in ventilated buildings.

This becomes more and more the case as the continual increase in lighting loads makes air conditioning more and more necessary to provide comfort for office personnel. Few of us realize how much these loads have gone up in a comparatively short time. Fifteen years ago, many offices in buildings such as the Mart had an average of 5 foot-candles throughout the space at desk level. The most recent large tenant who moved into the Mart has 100 foot-candles. Actually, lighting has become quite a factor in the heating of buildings. In buildings having 5 watts of lighting load per sq ft, the lighting would provide about 30 percent of the heat required in the structure in extreme weather.

It would appear important that a

BREAKDOWN OF OPERATING costs for air conditioning in a large office building

	Percent	Cost, cents per sq ft of rentable area
Energy cost — refrigeration equipment and pumps	15	1.5
Energy cost — fan operation	20	2.0
Labor and parts — refrigeration and pumps	13	1.3
Labor and parts — air distributing system	38	3.8
Filter replacement and maintenance (paper)	9	0.9
Filter maintenance (oil)	5	0.5
Subtotal	100	10.0
Depreciation		11.0
Total		21.0



SUCH ITEMS AS centralized control boards should be given careful thought in design of a building. It's a sizable labor item to turn on and shut off over 200 fans each day

uniform system of accounting should be used for the air conditioning and heating cost item, both in office buildings and by contractors figuring such work.

To be useful to the operator, the accounting should provide accurate cost figures for the various items entering into the air conditioning operating charge, such as

Heating cost — outside radiation.
Heating cost — fan coils.
Heating cost — process steam.
Energy cost of operating fans.
Energy cost of refrigeration equipment and pumps.
Filter service.
Labor — refrigeration.
Labor — distribution.

Regarding process steam, a recent survey made in our building indicated that the cost to the Mart for steam used in the building restaurants amounted to $28,000 per year — not including depreciation. Without a thorough analysis of this cost, one would never realize how much was involved in this item.

Costs in various buildings depend greatly upon the requirements of the tenants. We have found that it is necessary to change filter paper — even on filters where an oil filter is used in front — once per month (the actual change being made one-third each 10 days.) We find it necessary to have a staff enabling us to visit fan rooms four times per day. In designing a system for any large building, one would do well to give thought to such items as centralized control boards, as it becomes a sizable labor item to turn on and shut off over 200 fans each day.

REVIEW DEVELOPMENT OF DISTRICT HEATING

SPACE HEATING from the district heating standpoint was reviewed in a paper given at the Centennial of Engineering observance in Chicago last month. The paper was presented by A. R. Mumford, of Combustion Engineering-Superheater Inc., and was prepared by Ernest E. Dubry, Robert L. Fitzgerald, William A. Herr, Robert D. Martin, Leonard S. Phillips, J. Earle Seiter, and Glen D. Winans — all past presidents of the National District Heating Association.

Following is an abstract of this paper:

Sir Hugh Plat, an Englishman, made the first recorded use of steam for space heating in 1653. James Watt made and used what was probably the first primitive steam radiator, about 1784. About 1844 the Eastern hotel, in Boston, became the first building in this country to be heated (none too successfully) by steam. In 1882 the New York Steam Co. began high pressure, 85 lb per sq in, steam service to its first customer just six months before Edison distributed electricity for the first time in New York City.

Central station steam service grew more rapidly in the late twenties, in some cities, than any other form of public service, and few people realize that a district steam public utility serving all buildings in a given city would be a bigger business than the combined water, gas and electric business serving the same community.

District heating started, in some communities, when the local electric utility plants disposed of steam exhausted from the small engine driven generators by piping it to nearby buildings to be used for heating purposes. From the energy standpoint such a combination use of steam was highly economical but with the advent of condensing turbines the electric plants had to be moved to a plentiful condensing water supply usually remote from the heating load. The steam, formerly used for heating, was condensed and the heat dissipated in rivers and lakes. Today the cities having a supply of condensing water near the center of the steam load are bleeding the modern large high pressure turbines directly into the district heating distribution system. Some heating plants are avoiding completely the loss of heat to the condensing water by using turbine generators as pressure reducing systems exhausting to the steam heating system. Either the electricity generated or the steam exhausted can be considered a byproduct but in either case about one-half of the energy is saved.

The district heating plant is the mass producer of steam for heating with the advantages of efficiency and economy that mass production brings.

Utilization controls reduce energy consumption for space heating from 10 to 20 percent when the heating medium is available in any quantity instantly and when consumption stops completely with the cessation of demand. Utilization controls cannot be as effective with only the capacity of the small isolated plant behind them and with banking losses occurring after demand ceases.

How Piping Changes Pay

. . . . . by cutting fuel and steam waste and reducing plant production costs. Here are case histories that give specific examples

By C. T. Baker
Consulting Engineer

MANY BUSINESSMEN complain about continued increases in the cost of fuel and labor, increased costs of plant maintenance and increased overall costs of the finished product. All of us can sympathize with the business executive who faces such problems, since production costs and taxes take the lion's share of the income dollar. Sometimes, however, after making a complete survey of an industrial plant, I am puzzled. It is difficult to see how salaries, fuel bills and taxes are paid, considering the tremendous cost of preventable fuel waste which is often discovered.

Just why some plants permit preventable fuel waste and other losses to absorb such a heavy percent of gross profits is difficult for an engineer to understand. Of course, there are those who take the position, "Why attempt to reduce operating costs; any reduction in production costs simply means an increase in net before taxes and a larger tax assessment — so why worry about fuel costs, repair and maintenance costs, etc?" I know from personal talks that many business executives hold such views.

The following two case histories covering certain investigations I've made serve to illustrate how many plants can be so improved as to completely restore the investment in the changes in a very few years — in some instances, in a few months.

A large food processing plant operating two water tube boilers totaling approximately 750 hp and carrying a steam pressure of 155 lb gage was constantly bedeviled by high boiler maintenance costs and high fuel costs — besides finding it difficult to maintain full plant output during the normal operating season of nine to ten months. Bunker C oil — costing just under 6c per gal delivered — was burned.

Eight Reasons for High Fuel Cost

The fuel bill increased each year at a rate considered by the management as being out of all proportion to their operations. The figures covering ten months of operation totaled $85,500 in round numbers.

Several things combined to make up the sum total of the abnormal fuel cost. The major ones were:

1) Heavy scale deposits in the boiler tubes.

2) Forced boiler operation, which at times reached as much as 250 percent of rating.

3) Improper handling of the heat represented by the flash steam of the continuous boiler blowdown system.

4) The dumping of large quantities of hot condensate overboard.

5) Uninsulated steam and hot water piping.

6) Low temperature feedwater.

7) Badly leaking back pressure valves.

8) Bad condition of brick work around boilers.

These and things of lesser importance added up to a tremendous total of preventable fuel waste.

The boilers had been operated for so long under heavy overloads and high furnace temperatures that it was necessary to completely re-line the furnaces. This work is now under way.

Uninsulated Piping Wastes 50 Boiler Horsepower

A check of the exposed steam and hot water piping showed the losses from this source along exceeded 50 boiler hp. A contract has been let for labor and material to insulate completely all of this exposed piping — much of which is outdoors.

An examination of the pipe insulation in use disclosed that much of this covering was not fully effective because of the unsealed ends of the sections of insulation. This condition — too often found — permits the passage of air between the surface of the hot pipe and the covering and results in excessive heat losses. A 10 in. diameter steam main 83 ft long, carrying steam at a temperature of 368 F, represented one of the most flagrant of the many inexcusable preventable fuel wastes uncovered in this plant. This loss is being eliminated as a part of the program of plant improvement now under way.

Leaky Valve Pours Steam to Atmosphere

Feedwater for the boilers is preheated in a well known make of deaerating feedwater heater. This piece of equipment, while of the best on the market, was not functioning as it should and was not heating the feedwater much over 200 F, even though operated at a steam pressure of about 5 lb gage (corresponding to 225 F.)

Exhaust from the boiler feed pump furnished part of the steam to the heater, with the balance made up by live steam through a reducing valve. The reducing valve leaked like a sieve and poured steam into the heater at such a rate that the pressure relief valve was held open around the clock, passing live steam direct to the atmosphere.

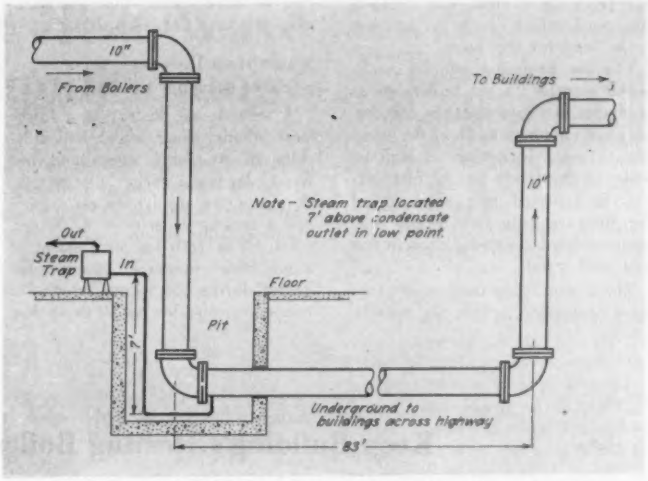
This valve has been returned to the factory for repairs.

Heat from Flash Steam Now Being Recovered

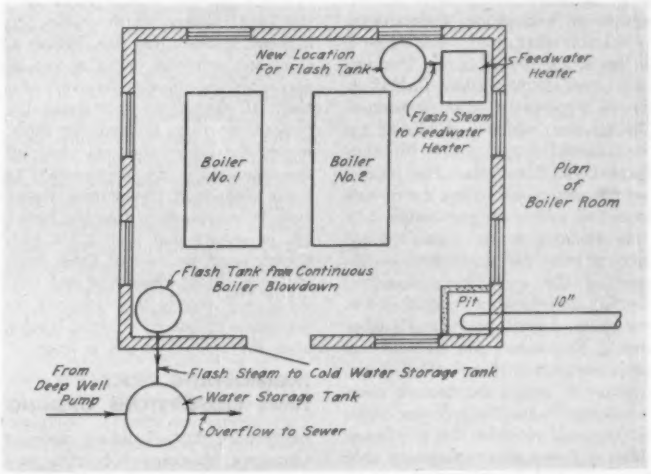
An excellent continuous boiler blowdown installation served the two boilers, yet the flash steam from the flash tank of this system was largely wasted. It was delivered to the feedwater storage tank located outside the boiler room into which was discharged water from a deep well at a continuous rate considerably in excess of the boiler feed requirements. Since the pump was not provided with an automatic cut out for starting and stopping it within some predetermined limit of tank water level, the tank ran over most of the time — carrying much of the heat absorbed from the flash steam into the sewer. This continuous overflow also carried away much of the comparatively small percent of the hot condensate delivered to this tank.

The rehabilitation program now under way includes the recovery of the heat of the flash steam by delivering it direct to the deaerating feedwater heater. This will greatly reduce the amount of live steam that will be required to make up the deficiency of the feed pump exhaust.

With steam at 5 lb pressure properly admitted to this heater, it is expected that when this plant goes back in service the feedwater temperature will be close to 220 F. At this temperature, practically complete elimination of CO_2 and air from the heater should be realized.



LOCATION OF THE TRAP draining condensate from the 10 in. steam main is being changed so that it will be in the pit below the drain outlet in the elbow. It didn't do a good job 7 ft above the drain outlet, as shown here



FLASH TANK WILL BE re-located, as shown in this plan of the boiler room, to permit the flash steam to be recovered for heating the feedwater

While the hot condensate from some of the steam using equipment was recovered for re-use as boiler feed, most of it was wasted (as previously mentioned). A much larger amount was dumped overboard — which could have been piped to the central collecting tank already in use, at a nominal cost.

Hot Condensate Loss Eliminated

This loss is now being eliminated by the recovery of all hot condensate not subject to contamination. This should reach the feedwater heater at a temperature of from 175 to 180 F and will be of material help in reducing boiler scale and furnishing additional otherwise waste heat to the feedwater.

As an example of the waste resulting from condensate dumped overboard, there were six fruit dryers in service using steam at 30 lb pressure. These units were rated at 185,000 Btu per hr, based on 2 lb steam pressure, 60 deg entering air and air out at 100 deg. The conden-

sate from these units was dumped overboard, which — in my opinion — is "one for the book."

The raw feedwater will be conditioned external to the boilers so as to render it more suitable for use. This will eliminate much of the losses due to scale formation as well as reducing the labor cost of cleaning.

It is expected that when all of the improvements now under way are completed, a decided drop in fuel cost will result.

The things being done to improve plant operations include the installation of draft gages, flue gas thermometers and CO_2 recorders.

Waste Heat Recovery Saves Laundry Steam

A second case history is a fairly large laundry plant, which had difficulty in supplying steam and hot water demands during the winter. Water to the storage heater, which had a heating capacity of 4,400 gph from 40 to 180 deg with steam at atmospheric pressure, reached the heater during the winter months at temperatures as low as 40 to 45 deg.

By the installation of a heat exchanger (costing about $175 in place) using flash steam from the hot condensate recovery tank, the water was heated through an average range of 100 deg.

It does not stretch the imagination to realize the savings effected by this simple waste heat recovery device.

In spite of the preponderance of evidence in favor of waste heat recovery, many plants have failed to take advantage of this simple means of reducing production costs.

Keep Building's Heating Boilers Clean

CONSTANT ATTENTION to interior housekeeping of commercial buildings, consistent inspection of all equipment, and proper maintenance of exterior alterations were stressed in an article by Alan M. Purling, vice president of Arthur Rubloff & Co., in a recent article in Skyscraper Management, which is published by the National Association of Building Owners and Managers. The following paragraphs on boilers are quoted from this article by permission.

In cleaning boilers, maintenance men should use flashlights in inspecting the combustion chamber, the smoke chamber and the flue passages. Loose soot and ashes should be cleaned out as often as necessary rather than following the practice of letting the fireman clean his boiler "occasionally," just when he happens to think of it. Sometimes a thorough cleaning can only be accomplished when the boiler is not in operation, but most of these conditions may be corrected without interfering with normal operations to any great extent. More serious conditions should be noted for attention after the heating season is over.

Maintenance men should also make certain that the insides of the water chambers, glass gages, etc., are clean. There is no excuse for dirty gage glasses. The trycocks or petcocks, which are located on the water column to which the glass gage is attached, should be tested from time to time. If dirty water comes from either of the trycocks, it indicates a dirty condition, and dirty water won't make steam economically.

The drain cock located on the bottom of the boiler, which enables the fireman to flush out the boiler to eliminate sediment or as a test of corrosion, should also receive attention. If drainage water shows the boiler to be dirty, and ordinary flushing of the boiler does not clear up the condition, it may be necessary to use a compound. Sometimes it may even be necessary to take the boiler out of service and boil it out with a compound for two or three days. However, the observance of such condition will supply the necessary information for attention to the trouble after the heating season is over.

THERMOSTATIC CLOCK TIMES CORNERSTONE OPENING

ALTHOUGH THE building housing Chicago's Museum of Science and Industry was erected for the 1893 world's fair, it never had a cornerstone — at least a ceremonial one, without which no public building is really complete. So last month — to mark the Centennial of Engineering convocation — a cornerstone dedicated to the future, and containing such living things as seeds, radioactive materials, biological molds (for example), was laid.

A feature of the stone's contents is a thermostatic clock to count off the next 100 years until the scheduled re-opening. Operating on the same principle as a thermostat, it comprises two strips of metal that expand differently with temperature changes. It is set to register once when the temperature reaches 85 deg and then will not register again until the temperature has gone below 15 deg. It is thus expected that Chicago's summer and winter weather — despite its wide fluctuations — will operate the clock within the stone.

CONSTRUCTION CONTRACT AWARDS COMPARED

CONSTRUCTION CONTRACTS awarded in the 37 states east of the Rockies during August were $1,438,725,000— or 5 percent less than July but 14 percent more than August 1951, according to F. W. Dodge Corp.

The eight-month 1952 total of awards was $10,708,588,000, or 6 percent below the comparable 1951 figure.

Individual awards in August showed non-residential contracts at $519,940,000, or 8 percent less than July but 9 percent more than August last year; residential awards of $627,596,000 were 3 percent more than July and 11 percent more than August 1951; public and private works and utilities at $291,189,000 were 14 percent less than July but 33 percent more than August a year ago.

Comparing individual awards for eight months this year against eight months of 1951, non-residential were down 26 percent; residential were up 4 percent; and public and private works and utilities were up 21 percent.

How Does a Heat Wave Affect Air Conditioning?

We asked a well-known air conditioning engineer in Dallas to comment on the effect of the month-long period this summer when temperatures were in the 100's. Here's his brief "report" on the effect of such severe weather on air conditioning

By H. G. Gregerson

George L. Dahl, Architects & Engineers

THE ADMONITION THAT man shall live by the "sweat of his brow" was never more true than in Dallas during the August heat wave. The fortunate ones stayed indoors in air cooled offices and working spaces. Others just had to sweat it out. The man of the family arrived at his cooled office early and stayed late while his poor family stayed home or spent part of the day in cool theaters, stores, swimming pools or restaurants. (While checking out a cooling system in a store, I saw several people at least a dozen times in different departments over a period of around six hours and will swear they did not buy anything.) There are, of course, the more fortunate ones who have air cooled homes and offices and a few with air cooled cars.

The air cooled home in Dallas is not uncommon but the market is far from being saturated. A dealer made the statement that only about 1 percent of the homes having electricity have cooling. The market for package cooling units has been bullish — with every indication that it will remain that way until Dallas has a cold month of August. All the concerns making home installations have been busy. People who have central warm air heating are adding refrigeration. Others make extensive modifications in their homes in order to add cooling. Several housing developments are being built in the $12,000 and up class with air conditioning an integral part of the plans. The higher priced homes are largely planned with air conditioning a part of the home or provision is made for adding it later. And for those who do not want refrigeration, or cannot afford it, there is the evaporative cooler. Thousands of these have been purchased by people seeking cooling. When selected and operated properly, they do a fairly good job of keeping a house cool. One man went so far as to install lawn sprinklers on his roof; this gave him 10 deg of cooling.

The almost universal reaction to a hot spell such as Dallas experienced — 27 days with temperatures of 100 deg or more — is that the service departments of refrigeration and air conditioning concerns are overworked and far behind in their calls. However, a check of several engineers with service firms said the hot spell had little effect on service work. One engineer's explanation, in this connection, is that with the extreme heat the equipment is operating continuously without the attendant stops and starts or operation of unloading devices — thereby preventing some of the breakdowns.

Use of automatic capacity reduction controlled by suction pressure has introduced a new problem to the equipment operator and service man. If the cutout points are set too high, sufficient cooling to handle the conditioned spaces is lacking. I know of at least two cases where this happened. As soon as the cutout points were set low enough, adequate cooling was available.

Shows If Designs Are Adequate

Probably the greatest effect the protracted heat has for the design engineer is that it gives him a good chance to find out whether or not his designs for his air cooling jobs were adequate and/or properly laid out. If no complaints come in, he can pat himself on the back and consider himself a successful designer. However, it also brings out misunderstandings on the part of owners and operators as to what their equipment can do and how it should be operated. Often the poor design engineer gave his client all he paid for and more and still the client is not happy. In one such case, a thorough briefing by a representative of the designing and contracting firm made a disgruntled owner a happy one. (I wish it were always that easy.)

Unfortunately, very few owners care to pay for equipment that is much in excess of the amount required to hold a predetermined temperature. In fact, when buildings are planned and found to exceed the budget, it seems that the mechanical equipment suffers out of proportion to its share of the cost of the building. If the calculations were accurately made and a reasonable safety factor used, it is difficult to do any cutting in the mechanical design without seriously reducing the capacity to a point where it is doubtful that adequate cooling will be attained when the outdoor temperatures soar. In order to beat the heat, many building engineers operate their equipment 24 hr a day. Others start their systems early in the morning in order to get a head start on the heat. In our own two story building, the equipment was selected on the close side because extra floors were contemplated which would kill one of the large sources of heat inflow. Indicating thermometers have shown that it takes 2 hr in the early morning for the cooling equipment to lower the temperature in the conditioned spaces to 78 deg. Experience has shown that without this precooling, a temperature as low as 78 deg will never be reached that particular day if the outdoor temperature rises to 100 or higher.

Operating equipment over night can bring about difficulties the layman cannot understand. One such layman complained one morning that a light fixture in his office was leaking water. The condensation on the duct was eliminated when provision was made to start the equipment early in the morning instead of running it all night.

The past season — and others — have brought the day closer when most Dallas homes, offices and working places will be air cooled.

Central Coolant Piping

. . . . serves De Soto's new and modern engine plant

By James C. Bishop
De Soto Div., Chrysler Corp.

A CENTRAL COOLANT system for the machine tools is an important factor in making the new De Soto engine plant, in the Detroit area, one of the most modern and best equipped in the industry.

The system comprises a sluice, settling tank, pumps, filter and distribution piping. The sluice carries grindings from the machines to the settling tank, where most of them settle and are removed as sludge by a conveyor. The coolant is then pumped to the filter, and returned to the machines.

Coolant System for Steel Turnings

The design of the coolant systems for the steel turnings department followed the same general scheme as for the grindings department, as described in the September HPAC. There was some thought given to mechanical conveying of the turnings. However, it was desirable not to install mechanical equipment under the floor because the machines would be removing a lot of metal in a short time. If a breakdown occurred, the underground equipment would be covered with turnings before it would be noticed, making repairs very difficult. It was therefore decided to stay with the scheme of hydraulic conveying, even for heavy chips.

Due to the peculiar behavior of the chips, as indicated in the friction tests, the velocity was increased in direct proportion to the frictional resistance. There is no law of hydraulics for this assumption; it was merely a rule set up to take care of unknown behavior of the chips when designing the sluices.

In this way, a required velocity of 7.9 fps was established. Using a 10 in. diameter channel crock for a sluice, a gpm of about 1000 was estimated, with a slope of 0.034.

Credit is due the plant layout engineers, who placed the machinery operations in straight lines — thus facilitating the design of the coolant system. For instance, most of the grinding operations are in a separate department, so it was simple to run one sluice through the center of the department. The heavy lathe operations are also in straight rows, so it was only a matter of removing the sumps from the lathes and straddling them across the sluice so the chips drop out the bottom. In some cases where the sluice had to be run along the side of the machines, special automatic wipers were designed which scrape the chips off the machine each time it is indexed. Once the chips are in motion, high velocity jets assist them down a trough and into the sluice.

The turnings coolant system is 2½ times as large as the grindings coolant system. Due to the departmental layout and the size of the system, three sluices are used. They empty into a piano hinge conveyor located in a settling tank. The heavy chips, due to their size, remain in the conveyor and are carried out and dropped into a chip buggy. Small chips, which overflow the conveyor, sink to the bottom of the settling tank. The wiper blades provided on top of the conveyor scrape the settled material off the bottom of the tank.

Instead of the sluices discharging into a removable basket, the pump suction is protected by removable screens. The screens are arranged similar to filter banks which are used in air handling systems. The reason for a double bank of screens is so they can be cleaned while the plant is in production. A chain fall and trolley are provided for removing the screens. The screens are located in a screen pit which is adjacent the settling tanks. Coolant flows by

SAVES TIME, COOLANT

Since this central coolant system was put in operation a year ago, janitor work has been greatly reduced over what would have been required for the same number of machines, if each machine had its own coolant system. There has been practically no cleaning of machines. Instead, the janitors clean the pump screens twice a week and sweep up the department once a day. Although the coolant has not been changed, it is still clean and has retained its fresh odor. The amount of soluble oil used per engine has been reduced. There is no problem of disposing of sludge; instead, the mud-like waste from the settling tank comes out almost dry.

gravity from the settling tank into the pump screen pit through a 16 in. line.

The line was baffled at the settling tank entrance to discourage the entrance of sinking chips. It was desirable to keep the velocity through this gravity line low enough so that there would not be too great a difference between the water level of the settling tank and the pump screen pit.

The partition between the screen pit and the settling tank is provided with a window about 2 ft above liquid level. When the floor of the screen pit needs cleaning, the debris can be thrown through the window where it will settle onto the conveyor.

The filter used is a wound steel wire cartridge type, which employs a constant backwash to free the cartridge of any accumulation of chips. A centrifugal pump draws the screened coolant from the screen pit and forces it through the filter and to the various machines through overhead piping.

The arrangement of the overhead distribution piping is the same as for the grindings system. A portion of the coolant is introduced at the start of the sluice for velocity conveying of chips and turnings.

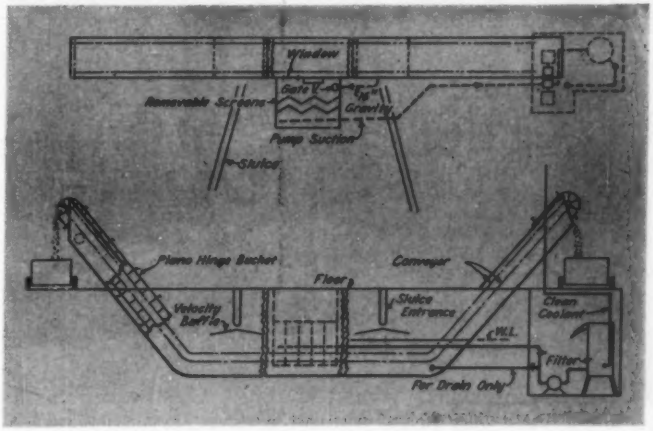
The Pumps for the Systems

The pumps for each of the coolant systems are arranged in duplicate. The pump room piping is valved so that either pump can be used. All valves over 3 in. are OS&Y pattern and under 3 in. are rising stem pattern. Check valves have oil resistant composition seats.

The piping system was designed for velocities above 10 fps to discourage the settlement of solids. The liquid line between the pump shaft and the casing was removed and the casing plugged. City water is piped directly to the pump shaft through a globe needle valve so that fine particles of metal are discouraged from crawling along the shaft. The pumps for the steel turnings coolant system are rated at 2500 gpm at 110 ft head; capacity is 3000 gpm at 80 ft head. The extra 500 gpm on the turnings coolant is for the automatic filter backwash.

A line between the pump discharge and a holding tank was installed. The purpose of the holding tank is to hold all of the coolant which is in any of the systems, so the settling tank can be pumped out for repairs. After such repairs have been completed, the original coolant can be pumped back to the settling tank — thus avoiding the necessity of mixing new coolant.

STEEL TURNINGS are automatically scraped from automatic drilling machine into coolant drain. Coolant has splashed on floor and top of drain trough because the splash guard had to be removed from machine in order to take this picture



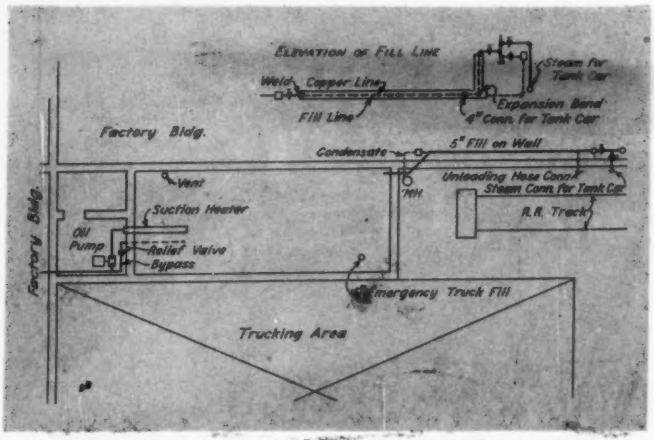
TURNINGS COOLANT system has three sluices, which empty into a piano hinge conveyor located in a settling tank

Handling Coolant for Aluminum Turnings

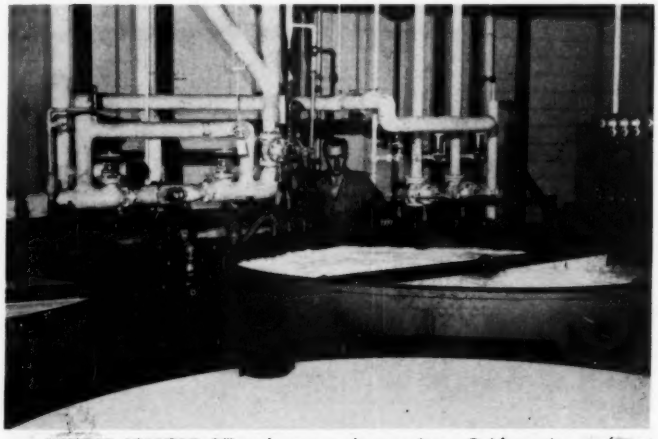
The coolant system for the aluminum turnings is fairly simple. Due to the specific gravity of the turnings, hydraulic sluicing of the chips does not require a very high velocity, 4 fps being ample.

The piping, pumping and sluices follow the same pattern as for the other systems. Chips are washed from the machines by velocity jets. The main sluice is 4 in. channel tile.

A settling tank is not incorporated in the aluminum turnings filter system. Instead, the sluice discharges directly onto a paper filter. The filter is located under the floor on a collection tank which is 14 in. deep, 18 in. long and 3 ft wide. Coolant



SIMPLE GRAVITY UNLOADING system is provided for unloading soluble oil from railroad tank cars. Steam heated line hastens the gravity flow



MIXING SOLUBLE OIL and water to form coolant. Quick-opening gate valves, oil and water meters, and signal panel may be seen in the picture

filters through the filter paper and into the tank. The pump handles 160 gpm against a 50 ft head. The turnings are conveyed up to a skid box on the floor, along with the spent filter paper.

Soluble Oil in Tank Car Lots

The soluble oil for mixing with water to form a coolant is bought in railroad tank car lots. When purchasing by tank car, the buyer can of course take advantage of the tank car price. Bulk handling of soluble oil also eliminates the hand labor.

A 15,000 gal concrete storage tank was installed at the end of a railroad siding. The tank was waterproofed and steel lined. The top of the tank is at grade level. The concrete roof slab is reinforced to withstand a 10 ton load. With this arrangement, the space alloted for outside traffic was not reduced.

A simple gravity unloading station is provided. Since the tank car unloading connection is located at about the center of the car, a 5 in. gravity fill line is run to about 6 ft from the side of the car center. Standard tank fittings and unloading hose is provided.

To hasten gravity flow, a steam heated copper line is installed inside the fill line. Steam and condensate lines are also provided for attachment to the tank car. Soluble oil is fairly viscous (3200 SSU at 40 F.)

For pumping the soluble oil to the mixing station, positive displacement pumps are provided, incorporating a relief valve and bypass line. The oil is recirculated constantly in cold weather. As the oil is withdrawn from the storage tank, it is pulled through a steam heated suction heater, which is thermostatically controlled so that the oil is pumped at a temperature of 80 F. Should no oil be demanded at the mixing station, the relief valve opens and the oil is returned through the bypass to the storage tank.

Coolant Blended at Mixing Station

The mixing station is designed so that any desired quantity of water and oil can be blended to form a coolant. Flow meters are installed in both the oil and water lines so that the coolant can be accurately mixed. Also, in case the coolant out in the system becomes too rich, plain water can be sent directly to the settling tanks. A direct-in-the-line proportioning type mixing valve was considered for simplicity sake, but this was not used due to slow delivery. Also it was felt that it would be more desirable to have a complete make-up of coolant in a standby tank always available for immediate use.

The mixing is accomplished by means of a venturi throat. The desired amount of oil is first metered into the mixing tank, and next the desirable amount of water is metered and run through a venturi fitting. The venturi action of the fitting draws the oil from the mixing tank, where it is intimately intermingled with the water and the mixed fluid returns back into the tank. This type of soluble oil mixes freely with water, provided the water is not too cold, so a steam heater was installed directly in the water make-up line, with a throttling valve and thermometer.

Four Tanks for Coolant Storage

There are four tanks for the storage of the mixed coolant. There are two for the leaner mixture used for grinding, each holding 1000 gal of

coolant. There are two tanks for the turnings line coolant, each of which holds 2000 gal. With this arrangement there are always two tanks of ready-mixed coolant on hand, so that there is never any delay for mixing a new batch.

There had to be some sort of warning device so that the operator of the mixing station would be notified when the settling tanks needed additional coolant. A signal arrangement which notifies the operator which tank is low was therefore incorporated. A panel board with indicating lights and an electric fog horn is mounted where it is visible from the traffic aisle. Electrodes are installed in the settling tank so that when the liquid level drops in the amount of 1000 gal, the signal flashes on the mixing station panel and at the same time the fog horn is sounded. When the operator mounts the mixing platform, he can shut off the fog horn and open the necessary routing valves and start the mixing station pump so that coolant will be pumped over to the settling tank which is signaling for coolant. When the horn sounds, both a red and a green light show on the panel board. Coolant is pumped from a mixing tank to the settling tank until the red light goes out, indicating the proper level.

MANNED ROCKETS POSE SPACE MEDICINE PROBLEMS

THE POSSIBILITY of manned rocket flights to the borders of space poses numerous problems of what would happen, physically and psychologically, to human beings traveling in the region beyond the terrestial atmosphere. This was brought out in an address last month by Heinz Haber, associate physicist in the department of engineering, University of California, Los Angeles, at the fall meeting of the American Society of Mechanical Engineers, held in Chicago during the observance of the Centennial of Engineering.

While, geophysically speaking, the limit of the atmosphere is located at about 600 miles above the earth's surface, he said, a new concept of the atmosphere must be found in relation to rocketry and aviation medicine.

At 10 miles above the earth, the oxygen content of the atmosphere is so low that a person hitting this border will lose consciousness in 15 seconds. The internal pressure of the body fills the lungs with water vapor and carbon dioxide so that no additional oxygen can enter.

At 12 miles the barometric pressure of the atmosphere can no longer prevent the body fluids from boiling.

After 15 miles the atmosphere will not sustain the combustion of fuel.

At 13 to 23 miles up cosmic radiation becomes a health hazard to man.

Ultraviolet solar radiation presents another hazard when man reaches the 22 to 28 mile altitudes, causing erythema of the skin and conjunctivitis. The bulk of atmospheric ozone, a more effective absorber of ultraviolet radiation than all metals, is found in the layer between nine and 25 miles up.

At 50 to 60 miles the atmosphere ceases to supply aerodynamic lift and drag, or, in other words, at this point the crew of a big flying rocket craft will be transposed into a state of weightlessness.

At 60 to 90 miles the absence of diffuse daylight provided by the atmosphere poses a visual problem.

One of the most intriguing problems of modern aviation is the generation of an envelope of hot air around a fast flying aircraft, owing to aerodynamic or friction heating, he said. It has been found that in a range between 80 and 100 miles of altitude, air drag and skin heating of a satellite vehicle for a velocity of 5 fps will become negligible. But temperature problems of rocket flight persist even at great altitudes. Beyond the border of thermal interaction between atmosphere and craft, there is the heat caused by radiation between the exterior of the craft and the sun, earth and cosmos. It has been found that gleaming white materials such as magnesium oxide can serve as surface coatings, if a manned craft is exposed to the field of thermal radiation in space.

From the standpoint of space medicine, temperature presents one other problem: that of human survival if the cooling system fails. It has been found that at 185 F a person would collapse in 60 minutes. At 500 deg, it would take three minutes.

ASKS HIGHER REFINERY YIELDS OF FUEL OIL

HIGHER REFINERY yields of heating oil, diesel fuel and kerosene are required in the next few months in order to avert an East Coast shortage of these products next winter, according to the Petroleum Administration for Defense.

Assuming normal weather, PAD estimated that middle-distillates consumption in PAD Districts I and III during the first quarter of '53 will average around 850,000 barrels a day above the level of the third quarter of this year.

APPRECIATES COMMENTS ON TV AIR CONDITIONING

I WANT TO THANK F. F. Stevenson — of Graham, Anderson, Probst & White, Architects-Engineers — for his comments in the September HPAC on my article on television station air conditioning.

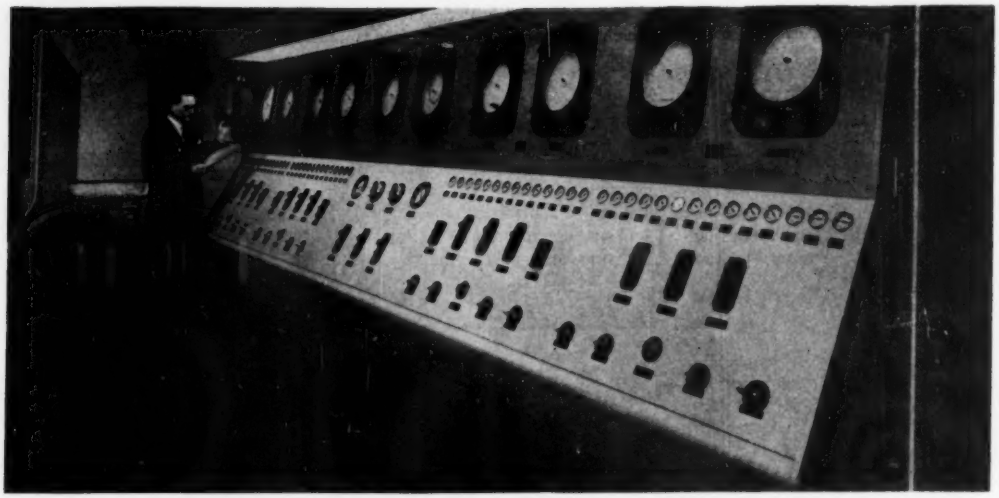
These very excellent comments by Mr. Stevenson will prove helpful to anyone designing an air conditioning system for television stations. Mr. Stevenson has enlarged upon several of the phases covered in my original article.

As Mr. Stevenson says, it is almost impossible to locate return air intakes at or near the floor level.

What he calls the "merry-go-round duct" has been used many times in order to get both the required length of sound absorbing material and also the number of elbows required to attenuate the high frequency sounds.

Use of the split systems in the control rooms is not practical with present television equipment. However, it is hoped that at some later date manufacturers of this equipment will provide some means of ventilating the equipment, and thereby reducing the amount of heat load which has to be removed by the air conditioning system in the control room.

I wish to commend Mr. Stevenson on his very pertinent remarks. — J. F. SCHMIDT, Application Engineering, Carrier Corp.



CENTRAL CONTROL BOARD in fan room not only is part of building's air conditioning but also serves as dramatic display of some of company's products and their applications

Take Their Own Medicine

Manufacturer of air conditioning and heating controls builds a new air conditioned office and a factory — all under automatic control

By Carl A. Gustafson
The Powers Regulator Co.

AN INCIDENT reported in the *New Yorker* magazine a few weeks ago referred to a situation which is not too uncommon in the air conditioning industry (although there are frequently better reasons for it than are realized at first glance.) Anyhow, the *New Yorker's* item told of a well-known firm of consulting engineers specializing in large air conditioning installations — complete skyscrapers, for example. A prospective client phoned them one hot day this summer about installing air conditioning in his own office, and said he would send over some blueprints by messenger. The consulting engineers told him to be sure the messenger came before 3 o'clock — they were closing their offices (which are not air conditioned) early because of the heat!

Comfort Conditions a Design Essential

When the Powers Regulator Co. built its new offices and its plant at Skokie (near Chicago), Ill., comfort control by air conditioning for the offices and of manufacturing conditions by adequate heating and ventilation in the plant areas were considered from the first as important essentials of the design. The comfort and efficiency that have resulted justify without question the wisdom of the decision.

The building is T-shaped, of conservative modern design, with overall dimensions 290 ft wide and 515 ft long. It contains 130,000 sq ft on a 13 acre site, allowing ample space for parking and future plant expansion. The two story office and laboratory section, 55 ft wide by 290 ft

long, is completely air conditioned. A stone ledge overhang strip above the windows helps reduce the cooling load in summer by keeping solar heat out. The cooling load is also reduced by the use of inner and outer window sash and venetian blinds.

The factory section is one story, 200 ft wide by 460 ft long, and has steel framed windows with glare-proof glass which reduces heat transmission from the sun by one-third. A well-insulated, lightweight poured gypsum roof reduces the heating load in winter and provides greater comfort in summer. The lightweight roof also permitted use of welded steel construction and 50 ft wide unobstructed bays.

There are three oil fired packaged boilers, and a similar gas fired unit for process and domestic hot water, in the boiler room. Underground tanks provide sufficient oil storage capacity for the three coldest months; they can be filled directly from railroad tank cars or oil tank trailers. The boiler room walls are glazed tile from floor to ceiling.

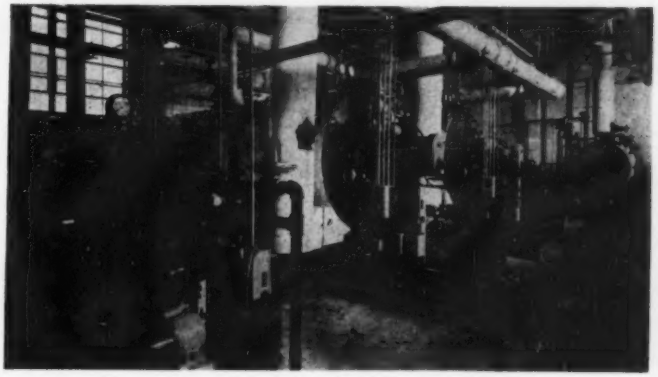
Four Major Air Conditioning Zones

The office building air conditioning system is divided into four major zones—administrative-sales, accounting-advertising, engineering-production and cafeteria. Each major zone has its own fan system with an air conditioning unit complete with heating and cooling coils, filters and humidifying sprays, individual controls, separate exhaust fans and refrigeration compressors.

Each of the four major zone systems is broken down into individual zones, consisting of from one to three or four offices. Each of these individual zones is equipped with a room thermostat operating a booster reheat coil valve and also a pressure-electric switch to provide cooling during summer operation. In each of the other rooms not under control by a zone thermostat, there is a thermostat to control the convector valves in winter and volume dampers in summer to maintain the temperature desired by the occupants.

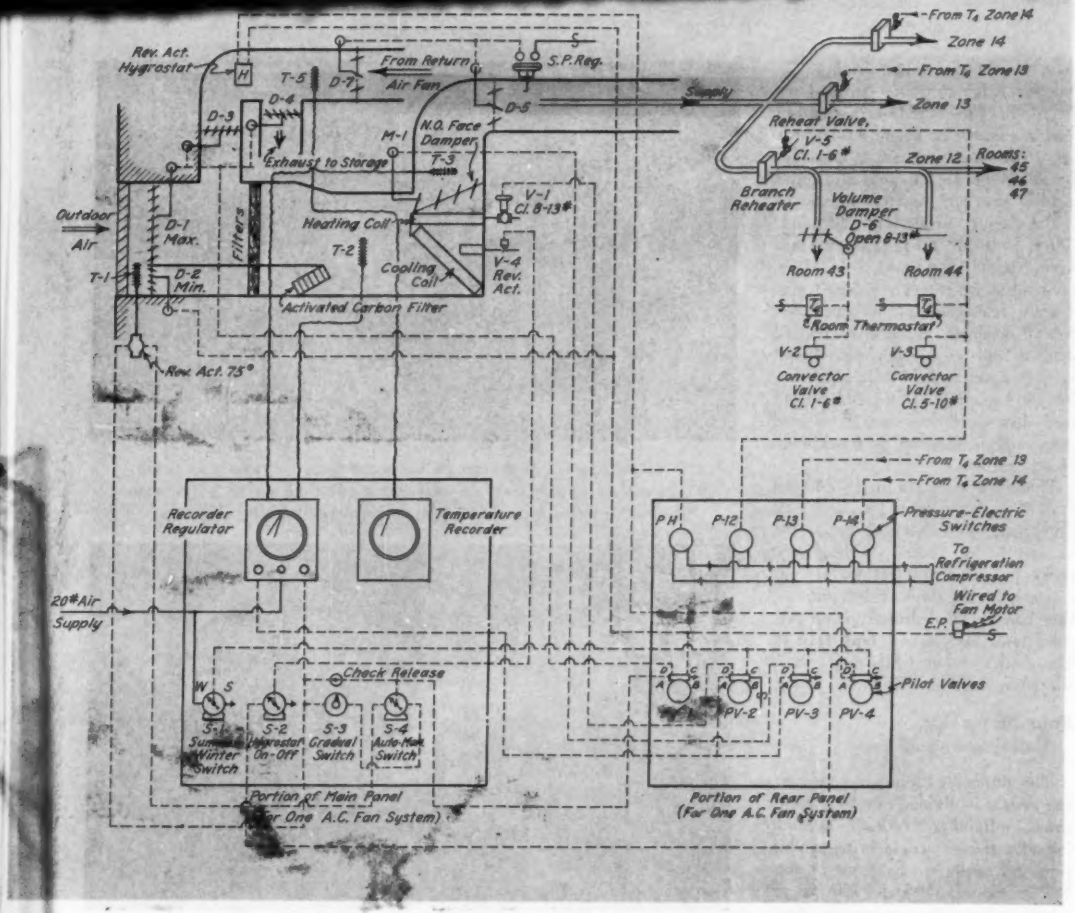
A hygrostat located in the return air duct to each fan controls the humidity. In winter the hygrostat operates a diaphragm valve to control the spray water. In summer the hygrostat can operate a pressure-

"UPSIDE DOWN" air diffuser on one of the two 20,000 cfm units supplying tempered outdoor air to the factory is installed this way as it was found that better air distribution resulted in this particular case



THREE OIL FIRED packaged boilers furnish hot water for heating the offices and factory. There is a fourth gas fired unit of similar design for process and domestic hot water

ENTIRE CONTROL SYSTEM is automatic except that the supply and exhaust fans and the refrigeration compressors are manually started. There are four compressors for air conditioning, totalling 100 tons



SCHEMATIC CONTROL diagram for one of the air conditioning unit systems

Central control panel shown in one of the photos is mounted with four sets of pneumatic controls as shown in this schematic, as well as electric pilot switches to start supply fans, exhaust fans and refrigeration compressor.

Winter Operation:

Summer-winter switch S1 is placed in "Winter" position to pass air to the C ports of PV2, 3 and 4 so that:

1) Thermostat T3 can control heating coil valve V1 and face damper to maintain desired low limit discharge temperature.
2) Hygrostat can control water spray valve V4 providing switch S2 is in "On" position and fan is running.

When fan is started, E. P. valve passes air to open minimum O.A. damper D2 and to PV1 so that thermostat T2 can operate maximum O.A. damper D1, return air D3 and spill damper D4 to maintain desired mixed air temperature.

Each air conditioning system supplies conditioned air to several zones. Each zone has a thermostat T4 which controls its respective zone reheat valve V5 and also valves V3 on convectors in its room. All other rooms in the zone have individual thermostats T4 which control convector valves V2 and also volume damper D6.

Summer Operation:

Summer-winter switch S1 is placed in "Summer" position to waste air from C ports of PV2, 3 and 4 so that:

1) Heating coil valve V1 is closed.
2) Face damper is opened and bypass damper is closed.
3) Humidifier valve V4 is closed.

When fan is started, E. P. valve opens minimum O.A. damper. Outdoor air thermostat T1 closes maximum O.A. damper and opens return air damper whenever outside air is above 75 deg.

With rise in temperature, the zone room thermostat T4 closes reheat valve V5 and then closes circuit in pressure electric switch P to start refrigeration. Return air hygrostat can also start refrigeration for dehumidification when required. Should the temperature in a zone become too cool, the zone reheat valve will gradually open, upon demand from the zone thermostat.

electric switch to start the refrigeration for dehumidification.

For each of the main air conditioning units, there are individual controls consisting of recorder regulators to maintain mixed air temperature and final discharge temperature from the units in winter and also a temperature recorder to show the return air temperature from each zone.

In addition, there are various manual switches to operate the outdoor air and return air dampers, a summer-winter switch, a selector switch for having the humidifier valve either opened or closed or placed under automatic control, and electrical switches which permit authorized persons to start their zone supply and exhaust fans as well as the refrigeration when required in summer.

All of these controls are located on a benchboard control panel in the fan room. Also mounted on the center portion of the main control panel are recorders showing the outdoor temperature, city water temperature, hot water supply and return pressures, as well as the hot water supply and return water temperatures.

The entire control system is completely automatic with the exception that the supply and exhaust fans and refrigeration compressors are manually started.

Controlling the Hot Water Heating

The heating system employs forced hot water, the temperature of which is varied with changes in the outdoor temperature. This hot water control is maintained by the use of master recorder regulators and submaster indicating regulators located on a control panel in the boiler room.

On the boiler room panel are also the manual switches for starting and stopping the circulating pumps, as well as a program clock adjusted to reduce the temperature control point of the thermostats in the factory area for night operation and to have these thermostats revert to a daytime 70 deg in the morning. The thermostats in the factory area are all of the two-temperature day-night type and operate radiator valves on the extended surface radiation below the window sills and control valves on the unit heaters located near the ceiling.

In the factory there are two 20,000 cfm outdoor air units which deliver tempered air into the factory for ventilation and for making up the air exhausted through the various exhaust fans throughout the factory area.

STONE LEDGE OVERHANG strip over office windows helps reduce cooling load by keeping solar heat out. The building is of "conservative modern" design

30 Motor Driven Roof Ventilators

There are 30 large motor driven roof ventilators. In summer, this feature — with the well-insulated poured gypsum roof, the special glazing, and fluorescent lighting — all combine to make a sizable reduction in temperature inside the factory compared to outdoor conditions (approximately 10 deg temperature difference has been noted.)

The exhaust fans are installed throughout the plant for removal of fumes and odors from paint spray booths and drying ovens, metal parts washers, degreasers and dryers, the charging room, welding booth, soldering benches, dust collectors, toilets, locker rooms, the kitchen, etc.

Natural Lighting and Ventilation in Classrooms

The dimensions of classrooms as a means of determining the best way to use natural lighting and ventilation are discussed in research report No. 36 of the Texas Engineering Experiment Station at Texas A. and M. College, College Station, Texas. Written by William W. Caudill and Bob H. Reed, the *Geometry of Classrooms as Related to Natural Lighting and Natural Ventilation* contains a discussion of testing methods used, reports of specific tests relating to the geometry of classrooms and an analysis of nine classroom shells.

Study of Heat Loss from the Skin

Each month the Office of Technical Services of the U. S. Department of Commerce releases a *Bibliography of Technical Reports* containing scientific and technical research done by the federal government or with the government's financial aid. In the August issue the subject is technical advances which promote protection of human beings against present-day hazards. Two of the reports on protection against heat and cold exposure are of special interest.

One, "Studies of Cutaneous Heat Losses, Part II: Regional Rates of Evaporation from the Skin at Various Environmental Temperatures" shows the results of studies on the evaporation of water from the skin at 24 to 38 C.

The second report, "Studies on Cutaneous Heat Losses, Part III: Dermatomal Recruitment of Sweating in Response to Generalized Radiant Heating," discusses heat loss from the human body, water evaporation and the measurement of skin temperature.

The Bibliography is available from the Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C. at 50 cents a copy.

Recommendation for Packaging Pipe Fittings

Copies of *Simplified Practice Recommendation R248-52*, Packaging of Standard Malleable Iron Screwed Pipe Fittings, Black or Galvanized (for 2 in. Pipe Size and Under), now are available. At the request of the American Gas Association, and with the cooperation of the manufacturers, a simplified schedule of standard packaging has been established for pipe fittings having a 150 lb steam working pressure.

Copies may be obtained from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. for 5 cents a copy. A discount of 25 percent will be allowed on orders for 100 or more copies for a single address.

Cathodic Protection

. . . . for preventing corrosion. How it works, where it is used, what savings are possible, why it's important

By J. F. Hirshfeld
Vice President, The Hinchman Corp.
Consulting Corrosion Engineers

DURING THE PAST few years, almost everyone connected with underground or underwater metal structures — including radiant heating and snow melting installations — has heard of the engineering technique for preventing corrosion called cathodic protection. As with every engineering development of wide application, a certain amount of mystery and even misinformation has surrounded cathodic protection. Consequently, it is appropriate to study the following questions:

What is cathodic protection?

Where did it come from and how long has it been used successfully?

Where is cathodic protection used?

What are the economics of cathodic protection?

It is the purpose here to explore very briefly these questions.

Cathodic protection is possible because of the electrochemical nature of corrosion. Simply, this means that wherever corrosion is taking place on a metal there is chemical change accompanied by a flow of electric current from the metal. The refined metals which are used for piping, tanks and other underground structures tend to revert back to the original form in which they were found in nature as oxides or metallic compounds.

Wherever this process is taking place, metal particles (or ions) are leaving the metal and there is a flow of electric current from the metal. The result is the familiar pattern of underground or underwater corrosion with its attendant pitting and destruction of the utility of the structure. These currents may be very small. It is significant, for example, that 1 ampere of current flowing continuously from a piece of steel for a year can remove 20 lb of the steel. A like amount of current can remove 70 lb of lead. Corrosion is caused by a great many factors which depend on the surroundings or environment of the metal structure and on the condition of the metal itself.

Beating Nature At Her Own Game

It was stated above that corrosion is always accompanied by a flow of current from the metal at the point where corrosion is occurring. If the flow of current can be halted, the corrosion will be stopped. Cathodic protection is the application to the metal structure of sufficient electric current flowing continuously toward the structure to suppress or reverse all tendency for current to leave the structure. It has been aptly called a process of beating Nature at her own game.

There are two basic methods of applying cathodic protection. A metal which is more susceptible to corrosion than the metal being protected can be used as a current source. This is the galvanic cell or galvanic anode principle and it operates exactly as does the conventional dry cell battery. Magnesium, zinc and sometimes aluminum are used to protect steel, lead and copper by this scheme.

The second method of applying cathodic protection is to use an external current source such as a rectifier will provide and force current from an artificial ground bed to the metal which is to be protected.

The process of cathodic protection is, then, the application of direct electrical current flowing to the metal which is to be protected and it is made possible by the electrochemical nature of corrosion.

Cathodic Protection Is Not New

Cathodic protection is not new. In 1824 and 1825 Sir Humphry Davy presented a series of papers, before the Royal Society in London, on experiments which he had performed on the "Application of Electrical Combinations for the Preservation of Copper Sheeting of His Majesty's Ships of War." These papers point out the electrochemical nature of corrosion and describe experiments using cast iron and zinc to protect the copper sheaths on warships. Even a design criterion was established: "A piece of zinc as large as a pea, or the point of a small iron nail, was found fully adequate to preserve 40 or 50 sq in. of copper" [Reference No. 1]. This is the prin-

ciple of using sacrificial anodes of zinc, magnesium or aluminum for the preservation of underground or submarine steel structures.

Prior to Davy, in the latter part of the 18th century, Volta thought the source of electricity was in the electric charges produced by the contact of two dissimilar metals. It was Volta who first arranged the common metals in a series according to their contact potentials. Around 1840, Faraday (and subsequently many other investigators) thought the potential must have its source in the chemical reactions that take place at the electrodes. It is now realized that both Volta and Faraday were correct in part and that the summation of their views goes far toward making up the basis of modern corrosion theory.

Corrosion Processes Are Not Simple

Actual corrosion processes are not simple. They are extremely complex and in many cases there are still numerous unknown factors. This is true because of the many variables in corrosion phenomena — particularly those occurring in close proximity to the anode and cathode areas. For practical use, however, it suffices to realize that Davy was on the right track. He suppressed the anode currents (currents leaving the copper) on the copper by creating a strong galvanic couple and he stopped corrosion. It is rather like the process of plant growth. There remain many unknown factors in the mechanism of plant growth; however, we can control to a great degree the rate of growth by variations of known factors.

The use of electric current applied from an external source to prevent corrosion is, by comparison with Davy, a recent innovation. The street car and interurban period unwittingly ushered in the use of externally applied currents for corrosion protection, but it has only been recently that the truly beneficial services of these utilities in protecting other underground metal structures has been recognized. A whole rash of leaky pipes has followed on the heels of the trolley car retirement in almost every urban area. This is logical in that the bulk of our urban underground utility construction coincided with the street car era, or what might very well be called the "forced drainage" era of corrosion prevention. The engineer who applied "electrical drainage" to underground utilities to eliminate stray current electrolysis was actually applying cathodic protection, although he did not refer to it in these terms.

First Exploited To Protect Oil, Gas Lines

The method of externally applying cathodic protection to buried structures was first widely exploited in the 1930's for the protection of oil and gas pipe lines — mostly in the Southwest. Large underground investments, expensive product losses and contamination of property all provided excellent economic stimuli for a great deal of investigation and development of pipe line corrosion protection systems and their relation to the reduction of leakage rates. The results of these investigations now make up the bulk of the literature on cathodic protection.

From its extensive practical use in the oil and gas fields, cathodic protection has spread rapidly to other types of structures and to environments other than the soil. Each development has opened up new vistas for the application of cathodic protection. Extensive research and development programs have been undertaken to find practical criteria for achieving protection and testing the economic utility of protection for specific applications. Since practical engineering knowledge usually is far in advance of the engineer's commercialization of knowledge or his ability to sell his ideas to management, the use of cathodic protection, extensive as it is today, is still in its infancy — particularly for industrial use.

The Field Is Broad

The field of cathodic protection is broad. Any metal buried or immersed in an electrolyte (an electrically conductive medium) can be cathodically protected if sufficient current is used. That includes any metal we bury in the ground and any metal immersed in water — fresh or salt. It includes any metal container that holds an electrolyte.

Today's scope of cathodic protection perhaps can be more clearly understood from the following incomplete but typical list of applications which may be encountered in a general corrosion survey of a large industrial installation, a military reservation or a waterfront area.

Underground Structures
- Metallic piping for all utilities.
- Underground and on-ground tanks.
- Lead sheath cables buried and in ducts.
- Lawn irrigation systems.
- Culverts.
- Metallic sewers.
- Metallic septic tanks.
- Metallic conduit.
- H-piling.
- Sheet piling.
- Column footings.
- Radiant heating installations.
- Tower footings.
- Deep wells.

Above-Ground Structures
- Surface and elevated water storage tanks.
- Hot water storage tanks.
- Surface condensers.
- Water treatment plants.
- Sewage disposal plants.
- Metal processing and treatment tanks.
- Food and beverage processing tanks.

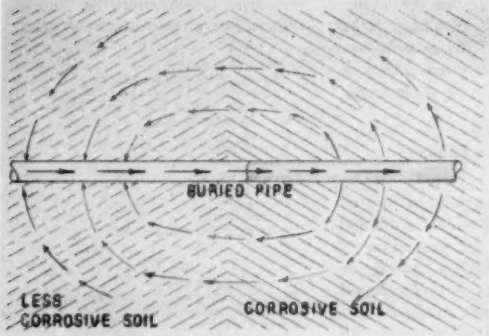
Marine and Waterfront Structures
- Steel piers.
- H-piling.
- Sheet piling.
- Barges.
- Floating dry docks (exterior and interior).
- Power plant intakes.
- Sea water flumes.
- Harbor installations.
- Lock gates.
- Drydock gates (exterior and interior).
- Ships (exterior and interior).

Another illustration of the scope of cathodic protection is that practical designs have been applied to things as large and complex as city utility networks and to steel piers over 1500 ft long. Things as small as a household hot water heater or a furnace humidifier can be protected cathodically and economically.

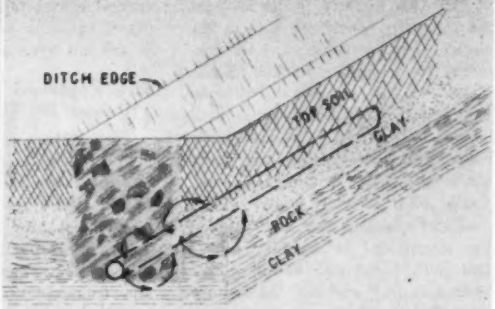
From the above list, it is evident that cathodic protection is finding far greater practical application than even the engineer familiar with corrosion problems has realized. This is particularly true of those who associate its use solely with pipe line practice.

A most important factor in the use of cathodic protection is its applicability to both old and new structures. On old structures it is used to halt corrosion; as long as the structure has not deteriorated to the point where it is useless, it can be saved. It is always an important consideration in the protection of old underground structures that it is not necessary to dig up the structure in order to protect it cathodically. New structures can be preserved without corrosion, which makes possible the use of lighter sections, more economical coatings and savings of materials.

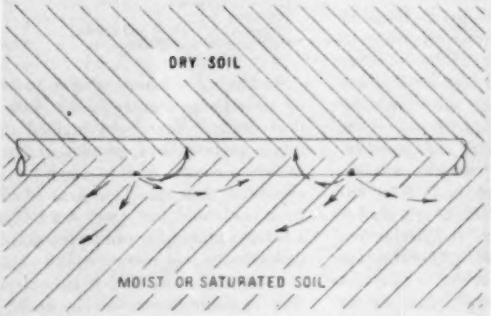
CORROSION CAUSED BY DISSIMILAR SOILS



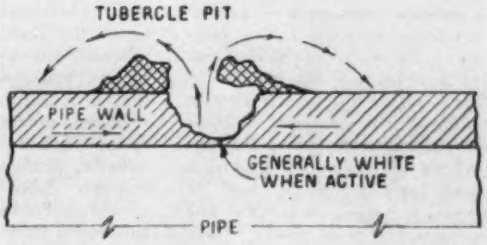
CORROSION CAUSED BY MIXTURE OF DIFFERENT SOILS



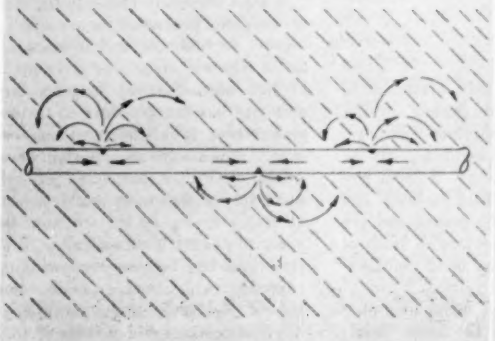
CORROSION CAUSED BY VARIATION IN MOISTURE CONTENT



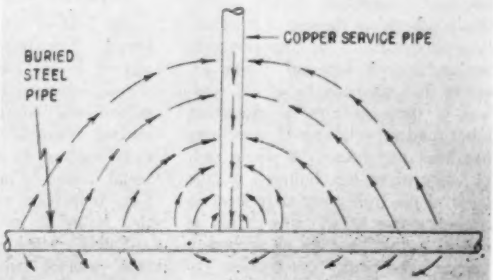
GALVANIC CELL
PIT ACTION



CORROSION DUE TO IMPURITIES IN SURFACE OF PIPE



GALVANIC CORROSION CAUSED BY CONNECTION OF DISSIMILAR METALS



Economics of Protection Are Complex

The economics of cathodic protection are complex because there are two types of losses that such protection can prevent. There are direct losses from corrosion, and indirect losses — which are generally conceded to be much greater than the direct losses. The direct corrosion losses have been estimated to be in the vicinity of $6 billion a year in the United States [Reference No. 2]. Analysis of this estimate shows that some $1 billion is subject to mitigation by cathodic protection — $600 million of this on underground pipe alone. This estimate was made in 1949 and since then the cost of both materials and labor have risen in substantial degree. Added to this is the fact that the above figures — while the best available — are admittedly very incomplete. Consequently, a fair 1952 figure of the direct annual corrosion loss which could be prevented by cathodic protection is probably well over $2 billion. The indirect losses include those occurring from product loss, product contamination, overdesign, loss of property and life such as are caused by fires and explosions, loss of production in plants and factories and indirect maintenance losses.

It is of course impossible to arrive at actual values of these losses. It is estimated, however, that they are far greater than the direct losses and that this is especially true for processing plants such as those in the petroleum, food and chemical industries and it is also especially true for large manufacturing plants.

For example, a power failure caused by corrosion of a lead sheath cable may cost only a few hundred dollars to repair, but the production labor lost by a sudden plant shutdown may cost many thousand dollars within the space of an hour. In a specific instance, replacement of a corroded gas service for a garage would have cost only about $90 or protection would have cost about $1 a year — but the garage blew up with a $100,000 loss before the service was replaced [Reference No. 3]. As a third example, repair and replacement of a radiant heating type of sidewalk snow removal system which has failed from corrosion is naturally much more expensive than the cost of the original installation — as well as causing a great deal of inconvenience to the owners of the property.

Examples Show Costs and Savings

Following are a few typical examples of the cost of cathodic protection against the direct savings achieved. In evaluating these savings, it is always most important to keep the indirect savings well forward in one's thinking. This is especially true for industrial installations, where the indirect savings are large in relation to the direct savings. Obviously, the opportunity for saving by corrosion prevention is tremendous and it would be folly to underestimate the value of the indirect savings which prevention of corrosion makes possible.

It is also unwise to approach corrosion from a strictly accounting viewpoint. From the accountant's position, there would be no corrosion problem if the structure failed the day after it was completely amortized, while if it failed when half written off, a serious problem would exist. The facts of life differ from this viewpoint. Structures are not usually retired from service on the day they are completely amortized; they usually continue in use for as long as they will perform a service. In any event, replacement is costly and is becoming more so as time goes on. Consequently, preservation of property is usually more economical than repair or replacement.

On a 12 in. bare metal mechanically coupled pipe line in locally corrosive areas, an estimated 172 future corrosion leaks were prevented by installation of magnesium anodes over a 3½ year period [Reference No. 4]. Applying average figures to repair costs per anode, the direct saving in this instance amounts to about $40,000 over the period involved.

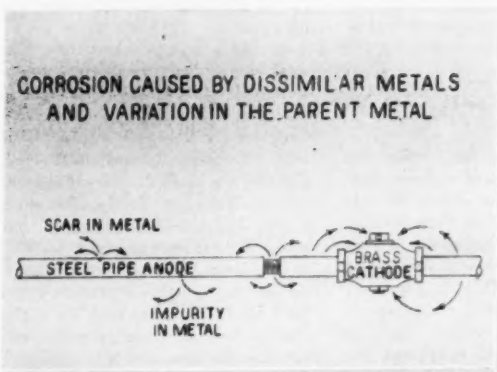
A pipe line 320 miles long might require in excess of $1.5 million to recondition and recoat. The interest on this amount, at 4 percent, is $60,000. The annual cost of magnesium anodes to protect the line is $10,000. Consequently, a net saving of $50,000 a year is obtained over the interest charge for reconditioning the line. Added to this figure should be the savings effected by uninterrupted service of the line and freedom from future deterioration [Reference No. 5].

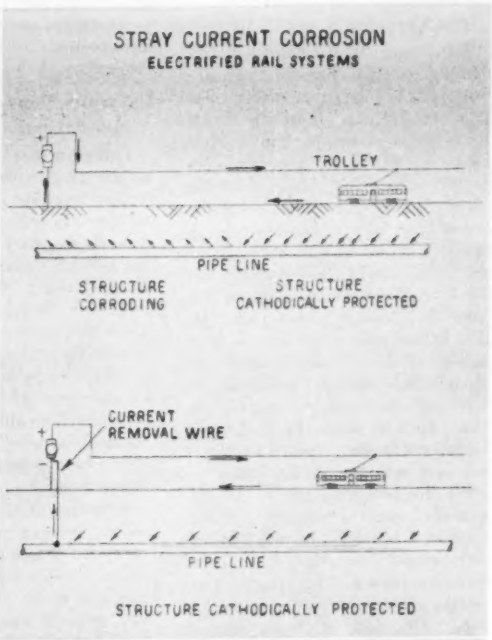
In 1942, in a southern city, the steel intermediate pressure gas mains were developing leaks at so fast a rate that complete replacement was budgeted for 1943 at a cost of $102,000. Cathodic protection costing $20,000 was applied. Since that time, only two leaks have developed in spite of the bad initial condition of the pipe. The net cash saving is $82,000 in this instance. On the interest comparison basis, cathodic protection has paid for itself in less than six years. Replacement of a high pressure gas main in the same area was estimated to cost $175,000. It was protected by cathodic protection costing $10,000, with a consequent cash saving of $165,000 [Reference No. 2].

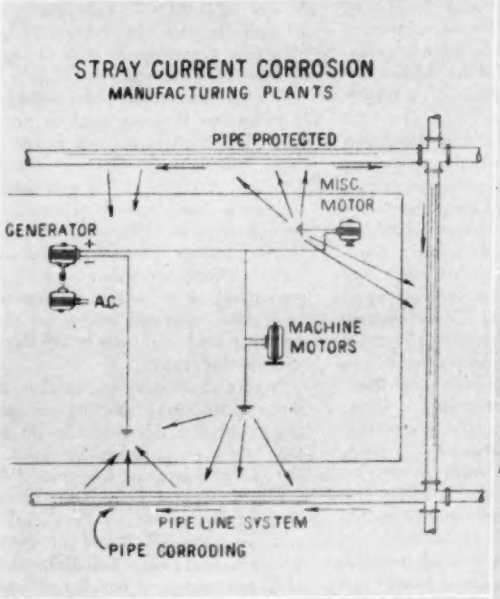
In a metal treatment plant, cathodic protection is being used to prevent deterioration of carbon steel tanks containing moderately corrosive acid mixtures at less than half the cost of other methods of reconditioning the tanks. [Reference No. 3]. Where coatings are used on process tanks, cathodic protection is proving economical as a booster protection to prevent corrosion where the almost inevitable pin holes or holidays exist in the coating.

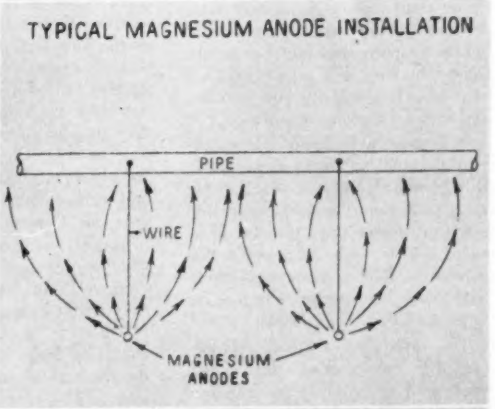
A very spectacular case is that of three underground gasoline storage tanks 120 ft in diameter by 20 ft high which are protected by a rectifier installation using less than $10 worth of power a year. The protective installation for all three tanks cost an estimated $2500 in 1941 when the tanks were installed. The tanks were examined last summer and were found to be in perfect condition after having been buried 10 years in corrosive soil. The cost of the tanks and their auxiliary piping was approximately $500,000. It is significant that heavy gage underground steel piping installed in the same general area but not having the benefit of cathodic protection has deteriorated to a serious degree, and that pits of similar depth would have perforated the gasoline tanks [Reference No. 7].

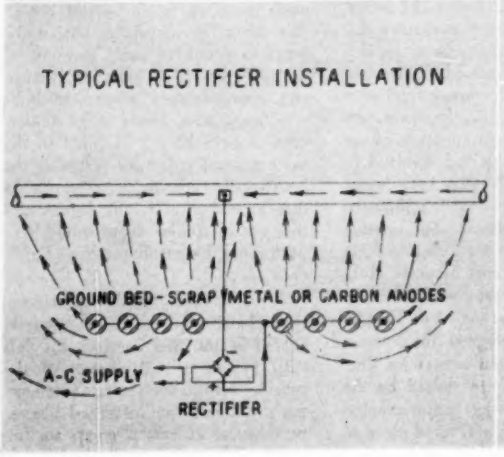
A gas company applied protection to $224,000 worth of new enamel coated mains and services for less than $1500, or 0.7 percent of the installed cost of the piping. The company estimates an increased life expectancy of at least 20 years for this

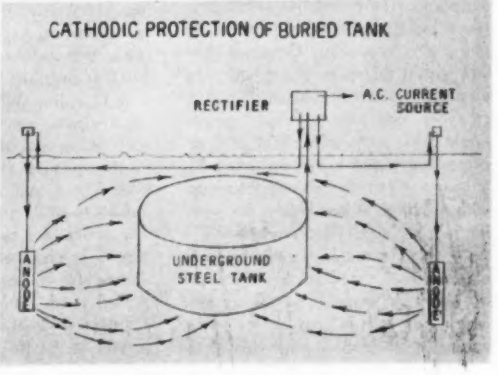

CORROSION CAUSED BY DISSIMILAR METALS
AND VARIATION IN THE PARENT METAL
SCAR IN METAL
STEEL PIPE ANODE
BRASS CATHODE
IMPURITY IN METAL


STRAY CURRENT CORROSION
ELECTRIFIED RAIL SYSTEMS
TROLLEY
PIPE LINE
STRUCTURE CORRODING
STRUCTURE CATHODICALLY PROTECTED
CURRENT REMOVAL WIRE
PIPE LINE
STRUCTURE CATHODICALLY PROTECTED


STRAY CURRENT CORROSION
MANUFACTURING PLANTS
PIPE PROTECTED
MISC. MOTOR
GENERATOR
A.C.
MACHINE MOTORS
PIPE LINE SYSTEM
PIPE CORRODING


TYPICAL MAGNESIUM ANODE INSTALLATION
PIPE
WIRE
MAGNESIUM ANODES


TYPICAL RECTIFIER INSTALLATION
GROUND BED - SCRAP METAL OR CARBON ANODES
A-C SUPPLY
RECTIFIER


CATHODIC PROTECTION OF BURIED TANK
RECTIFIER
A.C. CURRENT SOURCE
UNDERGROUND STEEL TANK
ANODE
ANODE

small expenditure. The same company, because of faith in cathodic protection, uses thinner walled pipe than formerly. For example, 4 in. pipe is now specified at 8.64 lb per ft instead of 11.35 lb. This amounts to a considerable saving on the pipe [Reference No. 8].

Cathodic protection of a 5000 gal buried tank under average conditions will usually cost less than $50 per year; often the cost will be as low as $20 per year. A 5000 gal tank under concrete with only a moderate number of connections may cost $1600. Since buried tanks usually are built of thin sheets, their life expectancy is not too long if a corrosive condition is encountered. The direct saving afforded by protecting the tank is obviously large.

Radiant Heating a Newer Application

The extension of cathodic protection to radiant heating installations is one of the newer practical applications of this method of preventing corrosion. Recent development work on these installations and experience with cathodic protection systems previously installed on radiant heating indicate that they require considerable more current per square foot of pipe surface than do most other types of underground systems. However, the cost of cathodic protection is still small in relation to the potential savings made possible by the prevention of corrosion.

On a recent sidewalk snow removal installation in Detroit which covers over 1500 sq ft in area, a corrosion survey indicated that cathodic protection would be advisable to prevent deterioration of the piping grids in the system. The installation was made for a total cost of approximately $1100 and the cost would have been substantially less had the cathodic protection been applied at the time of construction rather than as an afterthought [Reference No. 3].

Not As Simple As It Seems

Cathodic protection has a firm background of economic utility as well as a long history of practical use over a wide range of metal structures. As corrosion engineers are able to impress the truly large economic benefits to property owners, the uses of cathodic protection and the extent or range of any particular use are expanding rapidly.

There is, however, one important caution, without which an article on cathodic protection would be most misleading. That is, it is not as simple as it seems. On the surface, cathodic protection appears to be a most elementary application of a few very simple engineering principles. This, however, is not true.

There are many variable and complex engineering decisions to be made if a cathodic protection system is to provide economical protection to the structure for which it is intended and not cause electrolysis or "cathodic interference" to adjacent metal structures which are not to be protected. This is particularly true when cathodic protection is used underground in built-up or industrial areas. Because of these factors, the solution of cathodic protection problems is best left to corrosion engineers who, from experience, can evaluate the problems in their proper light. If the course of proper engineering is followed, cathodic protection can be economically installed and its benefits can be economically obtained.

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2) "The Cost of Corrosion to the United States" H. H. Uhlig. Chem. and Engineering News, 27,2764-67 (1949) September 26.

3) Hinchman Corp. records.

4) Dow Chemical Co. advertisement.

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8) "Experience and Economic Benefits from Cathodic Protection on Gas Distribution Systems." A. W. Peabody and C. L. Woody, Corrosion, Vol. 5, No. 11, November, 1949.

WARNS BUSINESS TO KEEP ALERT ON ATOMIC POWER

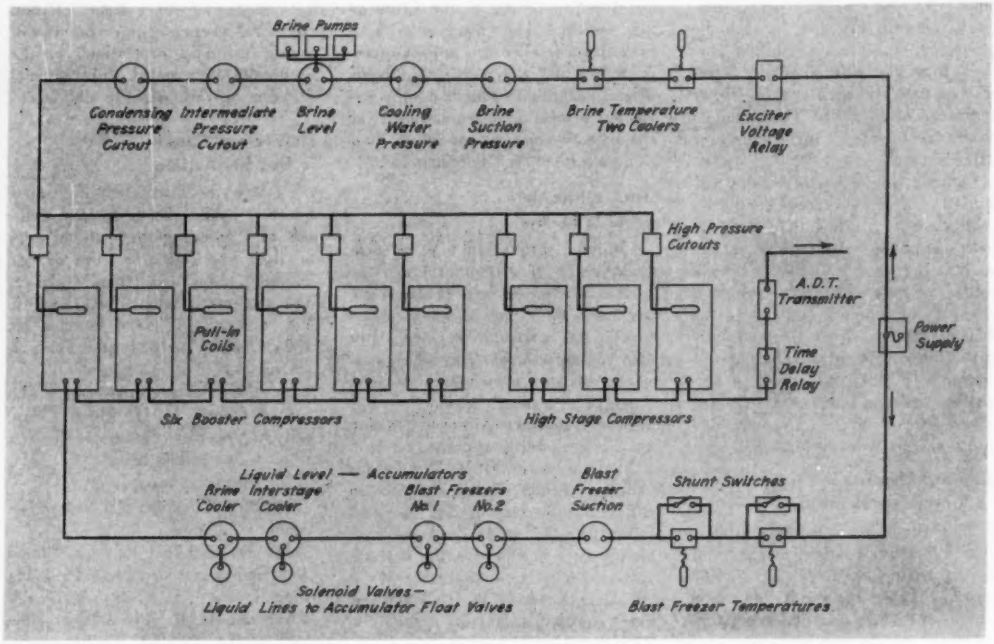
UTILIZATION OF ATOMIC energy by industry is "so close" that businessmen were warned last month to be alert against "the danger of getting caught with obsolete plants, processes and products." The warning came from P. J. Lovewell, assistant chairman of the department of industrial economics at Stanford Research Institute, Stanford, Calif. He was one of 10 speakers participating in a symposium on the industrial applications of atomic energy staged as part of the seventh National Chemical Exposition, sponsored by the Chicago section of the American Chemical Society.

"The introduction of atomic power and processes sired by the atomic energy program may begin on a modest scale within five years," he predicted. "In 10 to 20 years, the effect on business should be sufficient to be generally felt.

"Managements need have no fear that foreseeable developments from atomic energy will replace the economic need for their respective products and services, as the electric light replaced the gas jet," Mr. Lovewell said.

"Businessmen must remain alert, however, not to be caught with obsolete plants, processes or products that place them in an untenable competitive situation."

Present technical developments which will affect business fall into three types, he said. First, he mentioned the definite possibility of heat producing atomic reactors for the production of power. This is "perhaps only four to five years away, measured in terms of full-scale producing units," he said. Second, he continued, there is the potential industrial application of the radioactive byproducts of fission now stored as wastes. Finally, he said, there is the use of radioisotopes, already progressing rapidly.



THIS INSTALLATION "has opened the field for the automatic control" of large refrigerating systems of this type, says the author

"Electrical Night Shift"

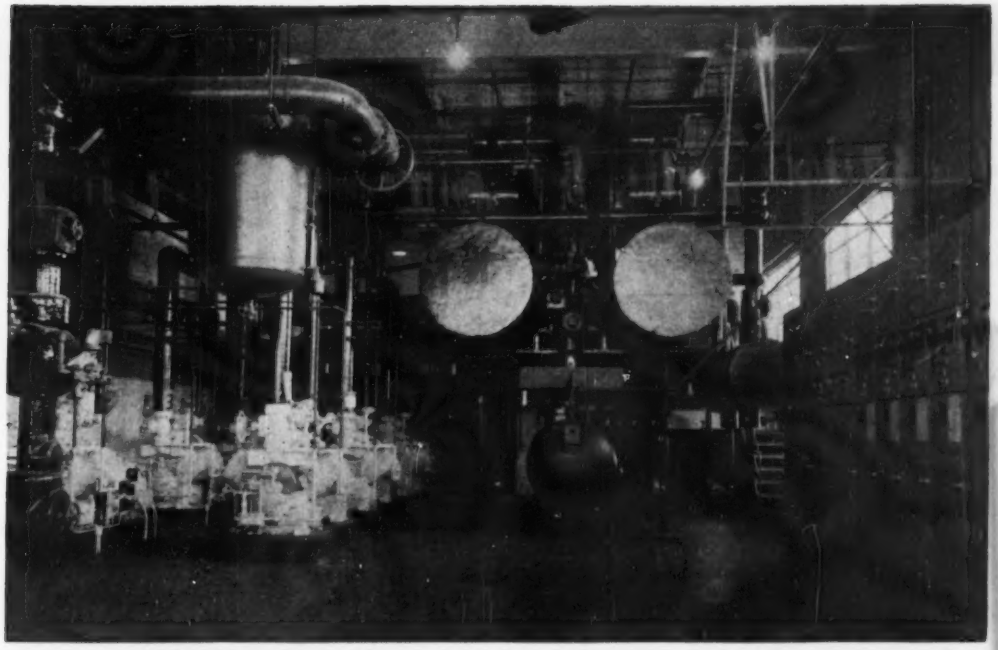
Automatic control for a large ammonia refrigerating plant adjusts operation to the load, guards against abnormal conditions

By John A. Holbrook

Head of Refrigeration and Air Conditioning Dept.
Belden Porter Co., Mechanical Contractors

HIGHER SPEED AMMONIA compressors, developments in electrical control, and more reliable mechanical equipment have made automatic control of even a large ammonia refrigerating plant possible. Such a control system must constantly adjust the refrigeration machinery to the plant load and must stand guard at all times to halt abnormal conditions.

To be of the maximum economic value, the system should operate the plant so that no attention will normally be required for two night shifts each day. Since most refrigerated products are quite perishable, it is essential that in case of trouble an operator must be notified immediately and must reach the plant in a reasonable time. Automatic controls therefore require the same 24 hr supervision that is essential for fire, burglar and sprinkler protection systems. The American District Telegraph Co., which operates in 1100 municipalities throughout the United States, is equipped for this service. It is only necessary to add a mechanical signal to their exisiting facilities. When the Merchants Re-



ENGINE ROOM OF the plant, showing (left to right) the interstage cooler float valve, booster compressor section, interstage oil trap, two shell and tube brine coolers, receiver, transfer receiver, and switchboard

frigerating Co. built its new 1280 hp Hopkins, Minn., plant last year, the owners decided to make the plant automatic and to use the A.D.T. facilities to supervise the mechanical equipment and to summon an operator in case of trouble.

1,750,000 Cu Ft of Cold Storage

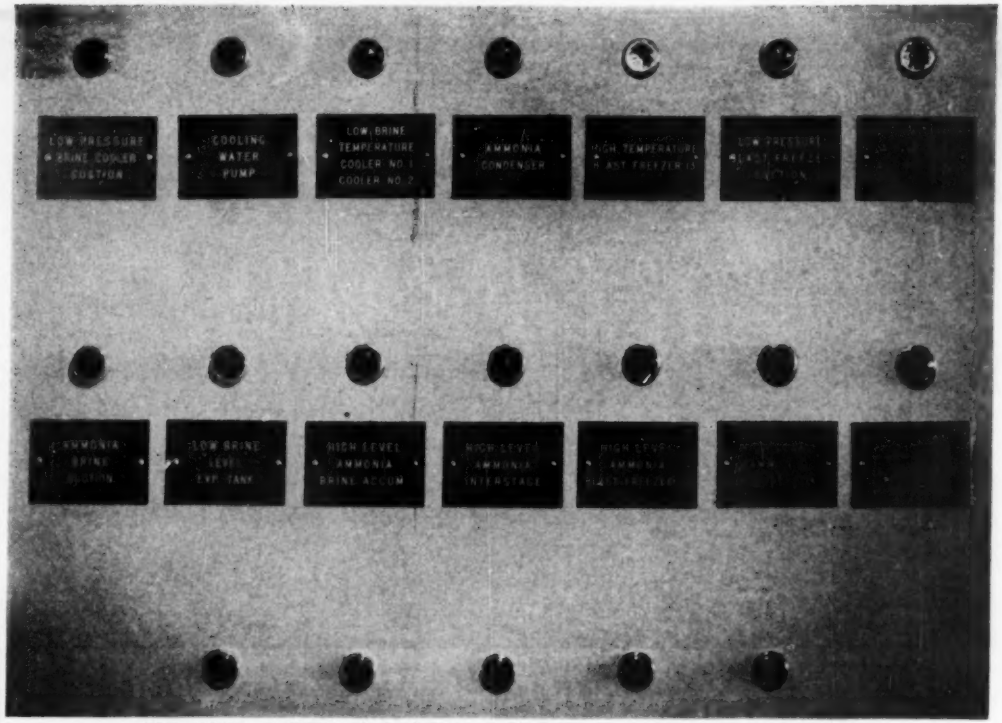
The 1,750,000 cu ft cold storage warehouse is cooled by calcium chloride brine circulated through finned pipe coils in each room. Supplementary to the storage rooms are direct expansion blast freezers.

The refrigeration cycle is a conventional two stage ammonia system with three high stage compressors, powered by 200 hp synchronous motors, and six booster compressors driven by 60 hp motors of the same type — two are for the brine system, two for the blast freezers, and two are spares. The compressors are six cylinder units with unloaders, turning at 720 rpm. The high and low stages are separated by both ammonia and water cooled intercoolers. The heat absorbed is released through evaporative condensers on the roof of the building and all cooling water is returned to an inside sump tank to allow winter flexibility in a severe climate. An atmospheric tower is also available for cooling the head jackets, lubricating oil and intercooler in summer. The brine is cooled in a pair of full flooded, 800 gpm shell and tube brine coolers. The blast freezers are also full flooded and have a freezing capacity of 50,000 lb of product in 24 hr. From the size of the plant and the number of its functions, it can be seen that automatic control is rather complex.

Prime Function of the Automatic Control

The first duty of the automatic control system is to adjust continually the refrigerating machinery to normal load changes so that the owner is not burdened by the power costs of overcooling or jeopardized by the liabilities of increased storage temperatures. These operating load changes are due to variations in the house demand, which are reflected by brine temperature changes; product freezing load fluctuations, which are reflected by changes in the blast freezer suction pressures; and condensing temperatures, which manifest themselves in the discharge head pressure.

The brine temperature changes — which immediately change the brine cooler suction pressure — and the blast freezer suction pressure changes are adjusted by the unloaders of the compressors. Each compressor is equipped with three stages of unloading — full load, two-thirds and one-third capacity — which respond to the suction pressure. With two machines on the line, these steps can be changed to full load, five-sixths, two-thirds, one-half and one-third capacities. Due to the thermal inertia of the storage warehouse, fluctuating outdoor weather conditions cause no rapid changes and one machine can easily follow the load for 24 hr with proper setting of the unloader steps. The blast freezer system is designed to operate with two booster compressors, both fully loaded as the operation is started. As the product approaches the desired temperature, the unloaders cut out compressor cylinders and excessively low blast freezer temperatures are avoided.



THE SIGNAL LIGHTS and the different signal circuits they represent are shown in this front view of the control cabinet

Piping and Control for Evaporative Condensers

The load on a refrigerating machine is a combination of the suction and discharge pressures. Through the use of the unloaders, the suction pressures are kept constant. However, the discharge or condensing pressure is determined by outdoor weather conditions — which fluctuate rather rapidly. Since the compressors pump their hot gas into evaporative condensers, and since the performance of a particular evaporative condenser is dependent on the entering wet bulb temperature, it is evident that the condensers must be controlled to give constant conditions. The evaporative condensers are controllable through the air flow and the water flow, either of which readily works into an automatic control system.

On the Merchant's job, the evaporative condenser sump water system was piped differently from the method employed on the usual application. All the pan water, which would normally stay in the bottom of the unit, is returned by gravity from all condensers to a central indoor sump tank. Each evaporative condenser has its own water circulating pump located at the tank. When a unit is out of service, no water remains outdoors to freeze.

The fan of each evaporative condenser is controlled automatically by a pressure controller in the hot gas line to the condensers. With the controllers set in sequence, as the pressure rises more fans are engaged. It has been found in operation that the water should be adjusted to give the desired head with about 50 percent fan capacity in operation so that changes up or down will be easily compensated for. In weather at about the freezing point, it has been found that water only — with no fans — will give satisfactory condensing conditions; and in temperatures from about 10 deg on down, that fans only will give proper operation. This flexibility of water and fans, water only, and fans only makes the normal operating control easy after a little experience with the system.

Controls Guard Against Abnormal Conditions

With the load changes and condensing temperature fluctuations adjusted by the unloaders and the fan controllers, respectively, the automatic system had to be designed for the abnormal conditions which might cause serious damage to the plant, contents or equipment if not corrected immediately upon reaching the danger point. These abnormalities can be classed as those requiring a total plant shutdown and those requiring the shutdown of only a particular piece of equipment.

Those conditions requiring a total plant shutdown are as follows:

1) A leak in the brine piping system, which would flood the warehouse.

2) Abnormally low brine temperatures due to restricted flow through the cooler or excessive refrigeration, which would freeze the brine coolers.

3) Interruption of the cooling water to the oil coolers and machine jackets.

4) Failure of the direct current synchronous motor exciters, which would damage the motors.

5) General high condensing pressure.

6) Abnormally high intermediate pressure.

Any one of these conditions would be extremely serious and would be adequate reason for shutting down the plant immediately and sending an alarm.

A second class of trouble which the plant may experience is localized in a particular piece of equipment and can be checked by stopping the faulty unit:

1) The blast freezer and brine cooler accumulators and the ammonia cooled intercooler are equipped with float valves which might fail open and flood into the suction of the adjacent compressors.

2) Lubrication problems in a particular compressor. In this same category is blast freezer trouble which would signal high temperature if the unit is not cooling. The function of this section of the system is to stop the equipment before a dangerous condition results and to sound an alarm.

Control Circuit Is Divided

It can thus be seen that the electrical circuit of the automatic control system must be so divided that a certain group of instruments will shut down the plant immediately while another group shuts down its own particular equipment only, both groups indicating trouble to the A.D.T.

The group requiring immediate plant shut down incorporates the following units:

1) A float switch with equalizer piping attached to the brine expansion tank, opening the circuit if the brine level falls below the bottom of the tank. Also connected to this instrument is the control circuit for the three brine pumps, so wired that any pumps in service will stop when a low brine level is indicated.

2) A reverse acting pressure controller in the brine cooler suction main that will open on excessively low pressure, thus serving as protection against brine cooler freeze-ups.

3) A temperature controller in the brine leaving the brine coolers to act as further protection from freeze-up hazards. Either of these controllers will open on low temperature.

4) A pressure controller in the jacket and oil cooler pump discharge, which breaks contact if the pressure falls below the total dynamic pump head — thus indicating that the cooling water pump is not functioning. (It should be noted that this signal is pressure actuated and is not merely dependent upon an electric circuit to the pump motor).

5) A relay across the exciter voltage to break the plant shutdown circuit if the motor generator set furnishing excitation should fail.

6) High pressure cutouts in the condensing pressure line and the intermediate discharge manifold to shut down the plant on excessive pressures. (The controls are set approximately 15 psi above the normal condensing pressure so that any abnormal condition is caught before it reaches the conventional cutout point. This plant has so far operated at a maximum pressure of 160 psi and the high side cutout is set at 175 psi for shutdown and alarm).

The following instruments give an alarm only and shut down only individual pieces of equipment. (These are to be contrasted with the plant shutdown group).

1) High level controls on the blast freezer accumulators, which close the liquid line to the unit if the level gets above the setting of the controller. The alarm circuit is also opened.

2) High level alarms on the brine cooler accumulators, performing the same function as in Item No. 1.

3) High level controls on the ammonia cooled intercooler accumulator, again performing the same function as in Item No. 1.

4) Oil safety switches and high pressure cutouts on each machine.

5) High temperature alarms in the blast freezer rooms. (These controls are equipped with shunts to bypass the circuit while loading the freezer).

Other Features of Control System

In order to connect all of the above control units into a complete system with manually reset signal lights and performing the functions as described, it was necessary to incorporate the following features into the equipment:

1) The control voltage of all of the compressor motors has been separated from the power circuit of the compressor motor.

2) Each motor control panel contains signal contacts in addition to the normal equipment.

3) Each compressor motor pushbutton contains shunt contacts to close the signal circuit when the motor is intentionally shut down.

4) The main A.D.T. signal line contains an eight second time delay relay ahead of the code transmitter to eliminate signals while starting equipment.

5) By the use of manual reset controllers or relays with manual reset holding circuits, it is possible to have a signal light burning on the panel when the operator arrives on the scene — even though the trouble has corrected itself during the shutdown period. Also, in case of a plant shutdown the equipment remains off until started manually by the operator.

The schematic diagram of the control system shows the two basic circuits — alarm and plant shutdown. Starting with the power source, the series plant shutdown circuit can easily be traced to the control voltage terminal of each compressor starter and finally to the main liquid line solenoid valve. The control current for the brine pumps originates in the low level brine controller to stop the pumps on low brine level. Likewise, the alarm circuit — another series circuit — terminates in the A.D.T. transmitter after completing the time delay relay.

It should be noted that the solenoid liquid valves serving the accumulators are secondary operations of some of the controllers in this group. The alarm circuit is subsequently broken on plant shutdown by the opening of the motor starter alarm contacts. The pushbutton, signal lights, relays and the other side of the line have been omitted from the diagram in the interest of clarity.

The system has proved to be extremely satisfactory in operation. It has been in service night and day, thus releasing the operator for other duties. The cost of the entire system should be saved in the salaries of two men for one year. This installation has, we believe, opened the field for the automatic control of large systems of this type.

[The author of this article designed this system.]

ENGINES TESTED IN "POLAR LABORATORY"

90 below: One of the coldest spots in the nation is in the "polar laboratory" built by the Perfection Stove Co., Cleveland, to test the starting of internal combustion engines, the characteristics of fuels, lubricants and metals, and the efficiency of heating devices at temperatures ranging from 65 F to 85 below zero. The 90-below building is a 60 x 60 ft structure with the 30 x 32 ft subzero laboratory inside. The cold laboratory is refrigerated by three "F-22" compressors hooked up in a two stage system. A dehumidifier unit supplies make-up air to the room at minus 10 F dew point to dry the room prior to a pull down, which procedure greatly reduces the rate of frost build-up on the coils.

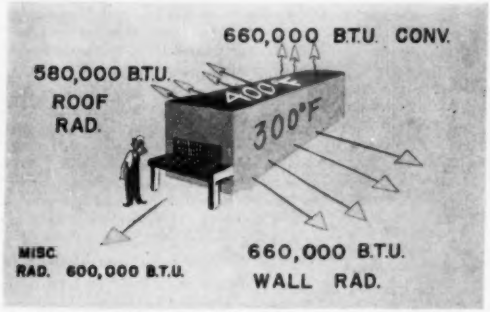


FIG. 1—TYPICAL FURNACE heat escape to building shows about 70 percent radiation

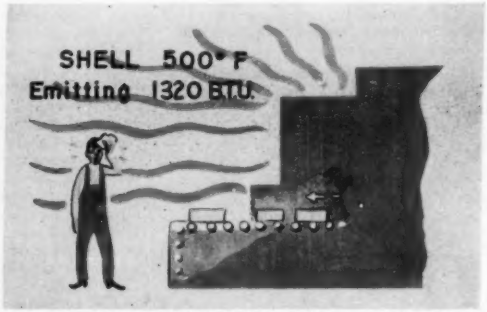


FIG. 2—HEAT CONDITIONS are shown at end wall of billet heating furnace

Heat Relief in Industry

Radiation is a major factor in producing discomfort due to heat. Fortunately, shielding can often markedly reduce such radiation

By Bartlett R. Small

Staff Engineer, Mechanical Engineering Dept.
Aluminum Co. of America

SITUATIONS OFTEN ARISE that require more effective heat relief for personnel around furnaces and mills than is commonly practiced. Any methods that can produce somewhat less cooling effect than refrigeration, but are more effective than ventilation, show promise of growing acceptance. Between these two extremes lies the field of heat abatement that is discussed in this paper.

As the logical first step in cooling hot areas, building ventilation rates can be economically increased by use of streamlined continuous monitor ventilators and high capacity powered fan roof ventilators.

Recently developed methods of radiant heat shielding by means of semi-portable reflective sheet metal curtains have created considerable enthusiasm. In the glass industry, no other method has approached the effectiveness and low first cost of radiation shielding. Special forms of personnel shielding include reflective clothing, and even reflective facial creams for hot repair work.

Severe conditions that fail to respond to shielding have been relieved by a third step, known as local or spot cooling. Ships have long depended on spot cooling in the engine and boiler rooms.

Today it is not too difficult to obtain cooled air for serious trouble spots; washed air, unrefrigerated but cooled by evaporation, can be delivered from grilles at 75 to 80 F when it may be 90 F outdoors. Other industries, having more severe heat exposures than steel or aluminum operations, have installations totalling many million cfm of evaporatively cooled air.

The troublemaker in a hot area may be molten metal, semi-finished metal or a furnace. The magnitude of radiant heat release from a hot carbon steel ingot is seldom realized. The following comparative values are examples (based on surroundings at 100 F mean radiant temperature and surface emissivity of 0.9):

2200 F ingot	—	77,000 Btu per sq ft per hr
1900 F ingot	—	49,000 Btu per sq ft per hr
400 F furnace shell	—	700 Btu per sq ft per hr
200 F steam radiator	—	176 Btu per sq ft per hr

This 2200 F ingot releases by radiation alone the equivalent of almost 3 boiler horsepower for every square foot of ingot surface.

The walls, roof and doors of either an open hearth or an ingot preheating furnace may release to the enclosed building about 10 to 20 percent of the fuel input[2].* For ex-

*Numerals refer to bibliography at end of article.

This paper was presented at a meeting of the Association of Iron and Steel Engineers, and published in the AISE journal, the Iron and Steel Engineer. It is republished here (with permission) to make the information generally available to ventilating, air conditioning and heating engineers and contractors and to engineers in plants who are concerned with these problems.

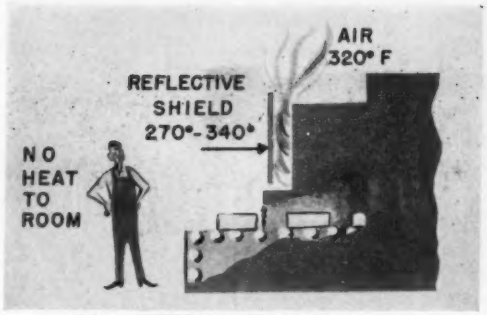


FIG. 3—SHIELD was added as shown here

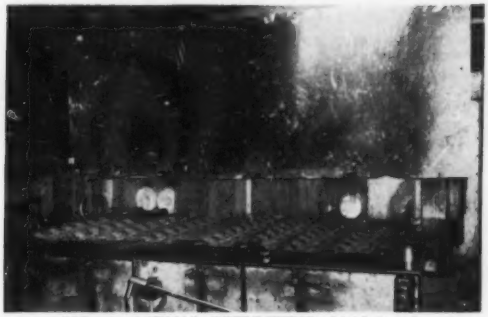


FIG. 4—ACTUAL REFLECTIVE shield in place

ample, an ingot preheating furnace 10 x 10 x 80 ft with 20,000,000 Btu per hr input, may release about 2,500,000 Btu per hr, the equivalent of three large blower type unit heaters common to steel mill buildings today.

The convection component in Fig. 1 refers to the hot air currents that rise and give the least trouble; but the other 70 percent of the total heat escape is radiation which heats every surface within visible range. Receiving surfaces such as structural steel, building walls, accessory equipment and adjacent machinery all become heated and actively reradiate in turn.

An illustration of this heat magnitude is the fact that a line of such furnaces, with the aid of solar heat, can frequently produce a 120 F surface temperature on the roof underside in summer. If it were possible to maintain this temperature over the entire area in winter, there would be enough panel heating capacity to take care of the whole heating load for a well-constructed building in zero weather.

Definite Relief With Radiant Heat Control

Recognition of high temperature radiation as a major source of discomfort is creating new avenues for securing improved heat relief. Attaining the comfort level of outside weather with radiant heat control seems improbable, but definite relief is possible — as those who have successful installations can attest. Radiant heat control has appeal because of the very low first cost, the absence of any mechanical equipment or moving parts and its grassroot type of effectiveness.

An experience last summer with a typical billet heating furnace, operating with conveyor chain and billets at 700 to 900 F, is an excellent illustration. There was a serious heat condition because of radiation from hot objects on three sides of a 12 ft square working quadrangle. The surfaces of the conveyor tunnel doors and end-wall ranged from 500 to 600 F (Fig. 2). A plain aluminum sheet was taken out of the plant metal stores, sheared to size, and clamped in position as shown in Figs. 3 and 4. Before shielding, the 500 F furnace end wall had a calculated emission of about 1300 Btu per hr per sq ft. The reflective shield, in spite of being heated by combustion products to about 300 F, emitted at the very nominal rate of about 33 Btu per hr per sq ft because of its 0.90 reflectivity.

As a side effect, the incoming draft of cool air that rising convection currents always create became noticeably pleasant as a result of the lessened radiant heat. A few days later a plant engineer reported the men were saying that, "This shielding is the best thing they have ever done for us." All the furnaces in this row were equipped soon after and the cost was less than $100 each.

Perhaps the Dewar flask first drew attention as a means for minimizing heat transfer. The flask's silvered surfaces practically eliminated transfer by radiation, while convection and conduction were reduced by the use of a high vacuum. This developed into the common thermos bottle.

In the case of an industrial furnace, the hot walls, roof and especially the doors are actively emitting energy in all directions. This invisible energy can be intercepted by an opaque surface and then transformed into heat. But heat radiation cannot be stopped from highly emissive surfaces as long as there are surrounding colder receiving surfaces. The receiving surface, however, need not be human bodies nor the surroundings. If the receiving surface is brought close to the hot object, it becomes known as a radiation shield.[2]

An intervening air space must be present or the shield will heat by conduction; i.e., metal to metal heat path and a thermal short circuit. The shield effectiveness depends on the reflective qualities of its surface. It can be said that a good reflective surface keeps cool in the presence of high temperature radiation.

All metals are basically good reflectors for infrared radiation, i.e., if the surface is clean and free of thick oxide films. Tarnishing and rusting may destroy the reflective qualities of mild steel and copper. Galvanized iron is affected less, and stainless steel and aluminum only slightly. On the other hand, the surfaces of non-metals have poor reflectivity and are highly emissive. In fact, their emissivities range from 0.85 to 0.95 of a perfect black body, and they absorb and emit heat readily.

Surfaces of many materials may be given reasonably good reflective values by the application of reflective paints. A new class of high temperature aluminum pigment paints having silicone or modified silicone bases can withstand 1000 F surface temperatures for extended periods. The good reflective qualities and spray painting characteristics place them conspicuously in the picture as a means of radiant heat control. Such paints can eliminate two-thirds of the radiant heat normally radiated, as compared to good reflective surfaces that can eliminate 90 percent.

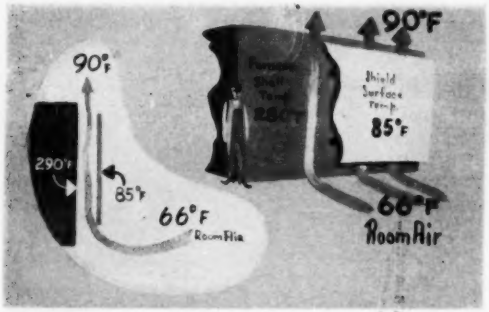


FIG. 5—SHIELDING RESULTS at remelting furnace

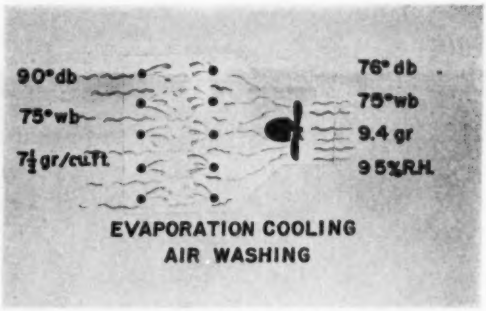


FIG. 6—EVAPORATIVE COOLING air washing

Shielding obtained some rather startling results at an open hearth type of furnace used for remelting aluminum throughout the industry. The steel casing of a furnace read 280 F. A 1/16 in. thick sheet of ordinary mill finish aluminum was set out 6 in. in front of it and clamped against the face of the vertical buckstays (Fig. 5). This reflective radiant shield quickly came to equilibrium at the unusually low surface temperature of 85 F when the room temperature was 66 F in the winter time.[3]

The chimney effect of this unobstructed stack, bounded on the front by the shield of 8 ft effective height and open at the bottom, produced a 25 F air temperature rise. Sufficient cooling of the brickwork and shell was thus assured with the shell heating up only 10 F to 290 F. The possibility of overheating the brickwork and shell is a real one and should be checked by thermocouples on any new application of shielding.

Perhaps the outstanding installation to date was made by one of the leading glass companies, which totally shielded several glass annealing furnaces on all four sides. Because of the large heat release and a low roof, the shielding sheets were extended up to the roof where ventilators were selected to balance the requirements. The method of mounting the shields is considered an essential feature. Threaded studs were welded to the columns using a stud gun, and sheets can be removed when necessary by removing wing nuts. Millwrights do not object to shields that can easily be removed and restored.

Materials with surfaces best suited for radiant heat shields are those that maintain high reflectivities for radiant heat and low emissivities under plant conditions.

All indications are that demountable reflective shields will be increasingly used, particularly for protection of specific working and operating areas near furnaces and hot metal. On the other hand, high temperature reflective paints will soon be furnished by more furnace manufacturers as a single coating that may suffice for combined shop and finish coat for furnace structures, shells, doors and door frames as a standard practice. Auxiliary equipment installed in the immediate vicinity may also be given this treatment to great advantage.

TABLE 1—EMISSIVITIES of various materials[4]

Material	Temperature of surface measured	Total normal emissivity
Aluminum foil	100 F	0.05
Aluminum sheet, clean	100 F	0.07
Aluminum sheet, oxidized at 1110 F	100 F	0.11
Aluminum paint, approved type	100 F	0.30-0.35
Steel, polished	100 F	0.07
Steel, oxidized	100 F	0.79
Tin, polished	200 F	0.05
Zinc, galvanized iron	200 F	0.07
Zinc, galvanized iron, dull	200 F	0.24
Brass, polished	100 F	0.05
Monel metal, not polished	200 F	0.16
Stainless steel	200 F	0.22

Spot or Local Cooling An Important Method

Spot or local cooling is the other important means of accomplishing industrial heat relief. This method might be divided in three classes:

1. Recirculated room air driven by mancooler or pedestal fans.
2. Raw outside air delivered by high velocity fans as a direct blow or through a duct system and grilles.
3. Outside air cooled by evaporation and in most cases conveyed by ductwork to permit reduced air volumes.

The mancooler fan is highly valuable in hot industries located in the middle Atlantic and upper Central States when the environment involves limited radiant heat and where room air remains below 90 or 95 F. Its contribution diminishes seriously in areas of 100 to 105 F air temperature. Physiologists report that a man's skin temperature is maintained at 92 to 94 F by the body temperature control system, and any exposure to rapid air motion at elevated temperatures contributes to body overheating through convection.

By the same yardstick, fan driven, outside air is a useful means of mancooling, and is most valuable for hot operations located near outside walls. In wide buildings, deficient of cross circulation in the interior areas, or in windowless buildings where semiskilled work entails little motor or furnace heat liberation, roof supply fans that blow downward with air distribution controlled by a ceiling diffuser are finding wide acceptance. Total first cost of 6c to 8c per cfm in new buildings is obtained. For large, hot areas that require ductwork, it has been the attitude that raw outside air as such is not worth the investment of 15c to 30c per cfm, be-

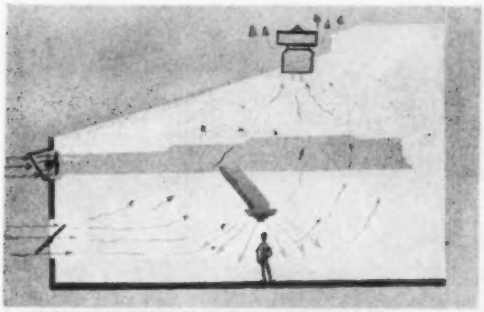


FIG. 7—SUPPLEMENTARY VENTILATION is required by evaporative cooling

cause of the lack of temperature difference and absence of cooling effect.

When the mancooler fan or the raw outside air fan becomes a hot blast and reaches a temperature of 100 F or higher, as pointed out, it is no longer valuable. It is true that the air motion of perhaps 300 fpm or even 1500 fpm does produce increased evaporation on the skin surface and the skin is cooler. However, continued profuse sweating is undesirable and may deplete a person's vitality. Even though the evaporation of sweat from skin surface is the best cooling mechanism, it should not be given the entire task of battling manmade heat exposure. In a noonday crossing of Death Valley in an open convertible, for example, both radiant heat and a hot blast air stream are well represented. To say this is strenuous is putting it mildly, for a person is exhausted without even doing any physical work.

The major cooling system of the fuel-burning human body is the vascular or blood vessel structure of the skin surface. If the body can be swept by air having some 10 or 15 F cooling differential, then nature's preferred cooling process, that of thermal equilibrium by convection, Table 2, is restored.

The Use of Evaporative Cooling

Evaporative cooling is a simple non-refrigerating method of lowering the temperature of outdoor air to meet this demand for efficient spot cooling, Fig. 6, which is not to be confused with space cooling. This specialized form of ventilation is obtained by the passage of outdoor air through an air washer (for example) and the resulting evaporation lowers the air dry bulb (ordinary thermometer) temperature and the sensible heat phase. A conversion to latent heat takes place and the moisture content of the air increases. For the performance described herein, this heat interchange is adiabatic; i.e., no heat is extracted as would be done if well water or refrigerative cooling were used.

The same spray water is recirculated with little waste and its temperature remains the same as the wet bulb temperature of the entering outdoor air. This wet bulb value, incidentally, is the temperature that the weather bureau never gives out in reports, even though it is valuable as the measure of total heat of outdoor air and is the best ready index of summer comfort. The 75 F design wet bulb for summer given by the ASHVE Guide for Chicago, and by coincidence also for Cleveland and Pittsburgh, is rarely exceeded. Air leaving the washer should be not more than 1 or 2 deg warmer than the spray water, rarely exceeding 77 F for those three districts. The maximum saturation is recommended because the cooler air can offset a 3 to 6 deg heat pick-up in the ductwork at hot areas and still be effective. Incidentally, ducts built of a reflective metal such as aluminum absorb less room heat, and duct insulative coverings have been avoided by the use of this material in various furnace rooms. Heat pick-up is further reduced by using comparatively high trunk duct velocities, averaging 3000 fpm.

Four simple precautions are suggested in order to avoid improper practices:

1. Use all outside air and never recirculate in hot weather.
2. Maintain adequate air motion around the men who are to be benefited. Though not scientifically developed, a minimum of 300 fpm, ranging to 1000 fpm under severe heat conditions, has been found successful. Adequately equipped air dampers that permit 80 percent velocity turndown are essential, thereby extending the system's usefulness to spring, fall and often winter, if room air is recirculated during these seasons.
3. Provide a split system whereby evaporative cooling is used in combination with motorized roof exhaust ventilators and sufficient fresh air inlet openings. In this way the two to five-fold greater volume of raw outside air holds down the overall temperature level in all areas of an obviously hot operation and sweeps out the spent washed air, Fig. 7.
4. Avoid application of evaporative cooling to offices and any areas free of hot operations except in recognized hot dry climates, of which the Southwest is typical. Offices require space cooling, whereas this study involves spot cooling in an environment of abnormal sensible or radiant heat.

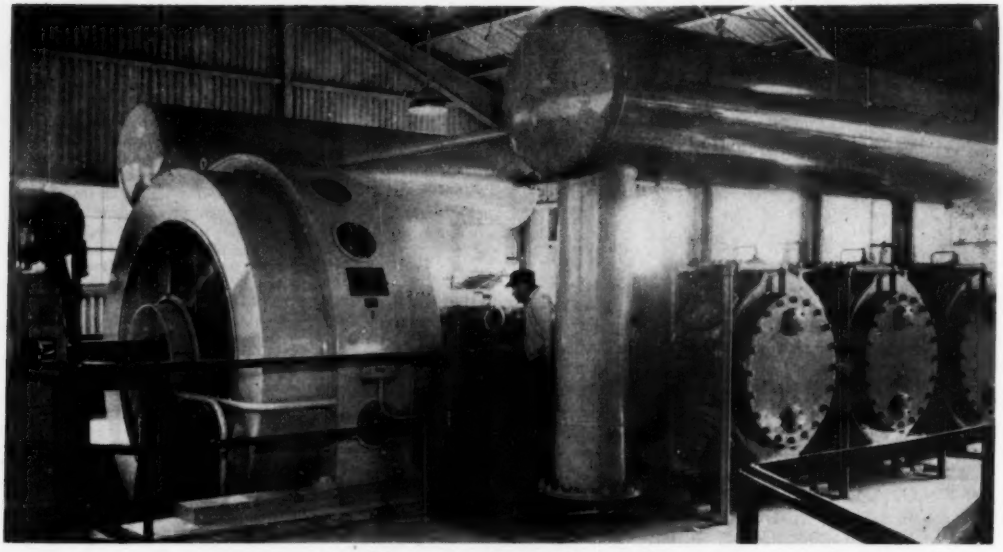
The writer's experience in installing central station air washer systems for combined humidity control and relief cooling in a number of Southern textile plants leads to the feeling that a resultant 60 to 70 percent relative humidity room air in still areas is not comfortable at moderate work rates. This is the reason for recommending a split system. The installation of excess exhaust is the natural thing to do in a large building, since air changes using simple outdoor air are more economical for the greater part of the building, with evaporative spot cooling for severe heat exposures.

Exceptions to the split system are mill motor rooms, direct mill motor cooling, internal combustion engine rooms and electrical control rooms because rapid air changes provide adequate air motion. In this field there is an increasing use of air filter washers for the combined purpose of obtaining dustfree air and evaporative cooling.

[Publication of this paper and the discussion on it will be completed in a succeeding issue.]

Table 2—COMFORT INDEX of air motion and effective temperature[6]

	Still air	300 fpm	700 fpm
Outdoors			
95 F dry bulb, 78 F wet bulb	84½	82	80
Evaporative cooling			
82 F dry bulb, 80 F wet bulb	81	77	73
Mill air			
105 F dry bulb, 80 F wet bulb	88	86½	85
Air conditioned office			
80 F dry bulb, 67 F wet bulb	74	70	68



A SYNCHRONOUS MOTOR driving a compressor

How To Improve Power Factor

. . . . . with synchronous motors. They also have other desirable characteristics

By J. C. Moore

Large Motor and Generator Dept.
General Electric Co.

HIGH PLANT POWER factors are of prime importance, because the load which any power system will carry is proportional to the plant power factor — which is expressed as the kw load divided by the kva load. The efficiency of the whole power system increases as the power factor approaches unity. A higher power factor may make it possible to safely increase the hp load on an existing system. It can also mean less investment in transformers, feeder lines, and voltage regulating devices where a new system is required.

Good operating conditions require high power factors, too. Poor power factor often results in voltage drops which increase the slip of induction motors to the point where production is adversely affected. If the voltage drops more than 10 percent below normal, it is quite possible for induction motors to become overheated or stall. And high power system losses, poor lighting conditions, high power bills, and increased maintenance of the power supply commonly accompany poor power factor.

In most power systems, poor power factor is caused by excessive demands for magnetizing current (reactive kva, which is equivalent to the square root of the difference of the squares of the kva and the kw) by induction motors at part loads, transformers, electric furnaces, electric welders, and other inductive equipment. This magnetizing current — although necessary — does no useful work, of course, and limits the power which a system can carry.

How Power Factor Is Improved

When a new motor drive (75 hp or larger) is needed, the installation

of a synchronous motor can economically improve plant power factor. A unity power factor synchronous motor (current in phase with the voltage) accomplishes this by adding to the kw load on a power system without increasing the reactive kva load, since it needs no magnetizing current to operate when normally excited at full load. In other words, it brings the ratio (kw/kva) closer to 1. For example, if a 1000 hp unity power factor synchronous motor is added to a 1000 hp plant load having a power factor of 0.80, the new load of 2000 hp would have a power factor of 0.935.

A leading power factor synchronous motor (current leading the voltage) improves plant power factor because it acts as a kilovar generator, and can supply fairly large amounts of kilovars to a power system while performing its usual driving duties.

The ability of either unity power factor or 0.8 power factor synchronous motors to improve power factor is a function of load and excitation. Decreasing the mechanical load without changing the field excitation increases the reactive kva output of the motor. The accompanying graph shows the reactive kva that two typical synchronous motors will deliver under various load conditions with normal excitation. It is seldom economical to operate a synchronous motor at part load in order to gain greater power factor improvement and the motor should never be overexcited for this purpose, as this practice can lead to serious overheating.

Another desirable characteristic of the synchronous motor with regard to its effect on the plant power supply is its tendency to stabilize the voltage. Under conditions of high voltage, the reactive kva furnished by a synchronous motor decreases, and under conditions of low voltage (within reasonable limits) it increases. The motor, therefore, has a tendency to hold a constant voltage in the power supply.

Furthermore, synchronous motors usually have a higher full load efficiency than other types of motors, and produce a greater amount of work per dollar's worth of power consumed. Where loads are heavy and continuous, an advantage of from 0.5 to 3.0 percent in efficiency saves a considerable sum in operating expense and leaves more power available for other equipment. At reduced loads, the difference becomes greater to a marked degree, for an efficiency of 75 percent at 5 percent load has been attained in a synchronous motor.

Choice Depends Upon Several Things

Whether or not a synchronous motor should be installed for power factor correction depends upon several things. A careful study might reveal that the particular plant and application might lend themselves better to induction motors and capacitors under certain conditions. The total cost, total load, present power factor, and amount of power factor improvement desired all have a bearing on the type of apparatus best suited for improving the power factor. And the provisions made for obtaining a high power factor in a brand new plant are likely to be quite different from those feasible in an existing plant.

A tabulation of multipliers which may be used to determine the number of kilovars required to improve power factor by given degrees is given on page 120. Another table lists kvar multipliers for 1.0 and 0.8 power factor motors for different desired system power factors. These tables may be used together to determine the approximate size of synchronous motor which would be needed to accomplish a required power factor improvement.

Characteristics of Synchronous Motors

Besides their ability to improve the efficiency of plant power systems, synchronous motors have other desirable characteristics which make them especially suitable for many kinds of large motor drives. Some of these are:

1) They may be obtained at very low speeds, thus eliminating or reducing the need for speed reducing gears.

2) The construction of low speed synchronous motors results in a saving in space along the shaft when the motor is to be overhung or built into the driven machine.

3) Split rotor construction is optional in low speed types, which facilitates assembly on the shafts of driven machines.

4) Low maintenance costs are the result of inherently simple construction, which leaves all parts accessible.

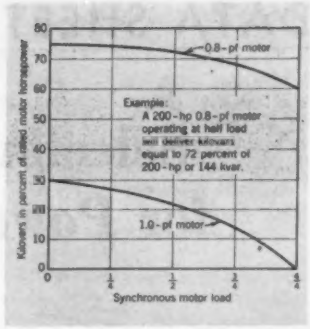
5) In ratings where the hp is equal to or greater than the speed, they have a lower first cost, including control and exciter, than other types of a-c motors with their control.

6) A wide range of torques is available to make possible starting under heavy loads.

7) Dynamic braking brings heavy loads to a smooth, quick stop.

8) They run at an exact rated speed. This constant speed feature is not affected by voltage changes.

9) They have an inherently large air gap, making field assembly and maintenance easy and economical.



APPROXIMATE KILOVARS supplied by synchronous motors. Kilovars are the reactive kva. Decreasing the mechanical load without changing the field excitation increases the reactive kva output of the motor

The combined economic and operating advantages of synchronous motors make their consideration worthwhile where a new large motor drive is required. In many instances, installation of synchronous motors is the most economical method of improving plant power factor when their ability to provide efficient mechanical power at the same time is considered.

✦ ✦

$1.2 billion plant: The U. S. Atomic Energy Commission announced last month that it will construct a new gaseous diffusion plant for the production of uranium 235 in Pike County, Ohio, about 22 miles north of Portsmouth, Ohio. About 6500 acres of land will be acquired. Preliminary design calls for a plant estimated to cost about $1.2 billion. It will require up to 400,000 kw of power — to be supplied from existing facilities — for early operations and new power plants will be built to supply the maximum of 1,800,000 kw needed when the entire plant is in operation.

Selecting Synchronous Motors for Power Factor Improvement

[See preceding article by J. C. Moore]

KW MULTIPLIERS for determining kilovars required for power factor improvement. *Example:* Plant has input of 200 kw at 80 percent power factor. To find reactive kva required to raise the plant power factor to a desired 95 percent multiply the 200 kw by the factor found in this table under desired improved power factor 95 percent and opposite the original power factor 80 percent, or 0.421 in this case. Kvar required, therefore, is 200 x 0.421, or 84.2 kvar

	Desired power factor of the system				
Original P. F.	80	85	90	95	100
50	0.982	1.112	1.248	1.403	1.732
55	0.768	0.898	1.034	1.189	1.518
60	0.583	0.713	0.849	1.004	1.333
65	0.419	0.549	0.685	0.840	1.169
70	0.270	0.400	0.536	0.691	1.020
75	0.132	0.262	0.398	0.553	0.882
80		0.130	0.266	0.421	0.750
85			0.136	0.291	0.620
90				0.155	0.484
95					0.328

KVAR MULTIPLIERS for determining horsepower required for power factor improvement. *Example:* To find horsepower rating of an 0.8 power factor synchronous motor required to furnish the 84.2 kvar determined by the above table. This table shows 0.8 power factor synchronous motor which has a *K* value of 1.24 when the desired power factor of the system is to be 0.95. Multiply this *K* (1.24) x the kvar required (84.2) which gives a value of horsepower equal to 104. The 0.8 power factor motor to be used in this case should be 100 horsepower. For a unity power factor machine, the multiplier would be 4.07. The *K* value times the required kvar (84.2) gives horsepower for a unity power factor synchronous motor of 343. A 350 horsepower unity power factor synchronous machine should be furnished in this case.

Unity power factor of synchronous motor		0.8 power factor of synchronous motor	
Desired P.F. of system	K 1.0	Desired P.F. of system	K 0.8
1.00	00	1.00	1.79
0.95	4.07	0.95	1.24
0.90	2.77	0.90	1.08
0.85	2.17	0.85	0.979
0.80	1.78	0.80	0.892

Air Locks in Ventilation System Protect Atomic Plants Against Contamination

"AIR LOCKS" BETWEEN "hot" and "cold" pressurized zones are used to protect personnel against deadly airborne contamination in atomic plants and laboratories, it was disclosed at a meeting of the American Society of Mechanical Engineers held earlier this year at the University of Washington.

New materials produced by nuclear fission, "more poisonous than anything previously known" are being processed on an industrial scale, and call for "extraordinary measures" to provide adequate protection for personnel working in close proximity with this type of substance, W. W. McIntosh, staff engineer, General Electric Co., told the ASME.

Mr. McIntosh said the principal sources of airborne contamination were gases and vapors evolved during processing, dusts resulting from evaporated solutions and particles released during handling of solid materials. Protecting workers against these is a job for the ventilation system of the plant or laboratory, he declared.

Radioactive materials are dangerous to living matter in two ways, Mr. McIntosh pointed out: one, by virtue of damaging radiation, and two, by poisoning on entrance of the material into the body.

"Materials of the first classification must be handled remotely and from behind shielding," said Mr. McIntosh. "Arrangements for protecting personnel within operating buildings from the hazard of these materials is, in some respects, the less difficult, largely because of the necessary remoteness of the operator from the source of danger."

Handling radioactive materials which are not emitters of dangerous radiation, however, is another matter, he said, explaining that it would be quite simple except for the "extremely toxic properties" of many of these substances.

"Previous industrial and chemical experience included processing many highly poisonous materials, but some materials encountered in nucleonic work are more poisonous than anything previously known," he said.

In addition to providing protective ventilation for normal processes which take place in hoods and equipment, design consideration must be given to the effects of all types of accidents such as explosions, fires, spills and other personnel errors, said Mr. McIntosh.

"An accident might make a room or possibly a whole building unsafe for occupancy; consequently, all practicable measures must be provided in the design for limiting the spread of radioactive contamination in the event of such an occurrence," he declared. "This is achieved by compartmentation of the building to such an extent as is compatible with efficient operation, and by design for controlled direction of air flow."

In designing for directional control of air flow, he said, one method is to provide controlled differential air pressure between areas of different degrees of hazard. These areas are usually designated as zones, the uncontaminated areas being termed "cold" and the areas of greater risk termed "hot."

"The zones of different hazard levels are completely separated structurally," Mr. McIntosh explained. "Access between zones is through air locks. Within each zone air is supplied to areas of least risk and exhausted principally from equipment, hoods or other areas of highest risk. Ventilation balance within the zone is such that flow through doorways is always toward the more hazardous side.

"The air locks are not ventilated, but on opening the door toward the 'hot' side air will leave the air lock toward the zone of lower pressure. When the air lock door to the 'cold' side is opened air will flow from the higher pressure area into the air lock; thus, air movement is in the proper direction. Air lock doors may be interlocked to prevent simultaneous opening which might upset the ventilation balance."

A modulating damper is provided in the exhaust system to maintain a constant exhaust pressure so as to hold the quantity of air exhausted at a constant value, he pointed out, adding that separate modulating dampers in the supply system maintain their respective zones at pre-set pressure levels.

Mr. McIntosh said another method of designing for controlled direction of air flow was to devise an architectural and ventilation arrangement wherein air is admitted to the cold zones and exhausted from the hot zones. Both systems are effective, he said, the choice of system being based on a detailed study of the operations to be performed in the building, heating and cooling loads, and structural and architectural arrangements.

Under the first system, called the "zone pressure ventilation system," maintenance of design pressure differentials between zones depends on the operation of the zone modulating dampers. If, in the event of failure of any of these dampers or for any other reason, the designed differential is lost, alarms are sounded and corrective action must be taken.

"The provision of one source of supply air and one exhaust system for all zones avoids the danger of zone pressure differential violations which might be caused by failure of one of several separate supply or exhaust systems," he said. "This alone is a determining factor in overall design, since reversal of air flow which might be caused by the failure of a single fan cannot be tolerated in some buildings.

"In the event of power failure it is seldom practicable to operate the entire ventilation system on auxiliary power supply. This contingency is usually met by providing exhaust ventilation only, at a reduced rate, with all automatic dampers on the supply system assuming an open position. Zone pressure differentials are not maintained under these conditions, but air flow is provided in safe directions. Ordinarily, operations within the building are curtailed as much as possible during power failures.

"Variations of this basic system have been used, but each departure usually involves the risk of failure

[*Concluded on page* 123]

BRAB Issues Report on Conservation in Building

LAST WINTER, THERE was held — in Washington — a series of conferences on conservation in building construction. The Defense Production Administration arranged with the National Academy of Sciences to conduct these conferences and to publish the findings and recommendations. The Building Research Advisory Board (BRAB), of the National Academy of Sciences, has prepared the complete report of the activities of the many advisory panels, and this report was published a few weeks ago. Discussion, development and application of the principles set forth in the report are favored and invited by BRAB.

Conservation means the satisfying of requirements for buildings with maximum efficiency in the use of money, manpower and materials. While certain recommendations were made in the possibility that during a national emergency there might be a serious shortage of labor and materials, the recommendations are intended to discourage unnecessary excesses in design at any time by anyone.

BRAB suggests that professional associations be urged to support the recommendations. I am not going to repeat here all of the recommendations of the advisory panel on heating, ventilating and air conditioning, but rather would like to mention a few of the high-lights.

A published appendix to the report gives some interesting data on government agency practices and discloses wide variations in specifications by five different agencies. There were repeated favorable comments by panel members concerning the Guide of the American Society of Heating and Ventilating Engineers, and recommendation was made that the practices in design given therein be followed by all heating and ventilating engineers. This is not to say that the Guide is complete and infallible or that it ever can become so. Several recommendations were made for further research by the ASHVE and for improvements in the Guide.

Among the outstanding BRAB recommendations are the following:

SAMUEL R. LEWIS, consulting mechanical engineer and a member of HPAC's board of consulting and contributing editors, comments informally each month on practical heating, piping and air conditioning problems. He reviews here some of the highlights of the recent BRAB report on conservation in building construction. Mr. Lewis served as a member of the advisory panel on heating, ventilating and air conditioning, of which W. R. Woolrich was chairman.

1) Influence of engineers concerned with construction of buildings that are to be heated should be brought to bear to secure not less than the following heat transfer rates in Btu per sq ft per hr per deg temperature difference:

Outdoor design temperature 0 F and warmer:

Offices, hospitals, dwellings: Roof, 0.12; wall, 0.25.

Workshops, hangars, garages, storage: Roof, 0.20; wall, 0.36.

Outdoor design temperature below 0 F:

Offices, hospitals, dwellings: Roof, 0.12; wall, 0.10.

Workshops, hangars, garages, storage: Roof, 0.12; wall, 0.20.

2) Acceptable minimum outside air supply for mechanical ventilation of rooms for human occupancy.

With tobacco smoking, 15 cfm per person.

With no smoking, 7 cfm per person.

3) Base heating apparatuses, including pipe and duct sizes, on the immediate demand — unless a definite future demand is expected within five years. Encourage provision for space and clearances for possible future apparatus but do not install it.

4) The advisory panel made no suggestions as to the employment of any particular kind of heating system for any particular building.

5) Encourage boiler water treatment to reduce corrosion of pipes. (There are interesting suggestions in the report of the panel on plumbing concerning copper and galvanized piping and fittings.)

Rating and Sizing Heating Boilers

6) All boilers should be rated in accordance with the methods of the Steel Boiler Institute or the Institute of Boiler and Radiator Manufacturers, and no boilers — unless so rated — should be specified.

7) When two heating boilers are required, select each boiler of a size for two-thirds of the gross load. When three heating boilers are required, select each boiler of a size for one-third of the gross load.

8) In times of national emergencies, omit standby boilers or similar normally idle heat producing equipment.

9) Where stokers, oil burners or other mechanically fired heating equipment is specified, select apparatus to develop 100 percent but not exceeding 125 percent of the gross output of the boiler or furnace served by the respective fuel burner.

10) During periods of shortages of critical materials, consider oil storage tanks of a size sufficient for not more than two weeks maximum

demand but large enough to accommodate the available oil delivery truck or car.

Use Standard Items of Equipment

11) Where standard products are obtainable, discourage specifying specially-designed equipment that is not a routine product of a recognized manufacturer.

12) Consider the possible use of trunk line duct velocities up to 4000 fpm, but beware of noise and power considerations that may prevent such pressures and speeds.

13) During national emergencies, air conditioning embodying a broad control of air temperature, relative humidity and chemical condition should be limited to those processes and activities which, without air conditioning, would suffer in production rate and quality.

Coordinate Structural, Mechanical, Electrical

14) Initial design coordination should be practiced between the architectural, structural, mechanical and electrical divisions of any building. This coordination especially is recommended to government construction agencies in their own design organizations, and should be practiced and required by architectural and engineering firms employed for the design of federal buildings.

15) Reduction of excessive ceiling heights and conservative use of glass area in many buildings that are to be heated will result in conservation.

16) Some administrative and construction practices used by government construction agencies limit the possibilities of conservation and ingenuity by designers. Do not overemphasize use of standard plans. Such plans frequently require special and expensive modifications for adaptation to sites and climates that vary from the standard.

Complex Specifications Prevent Competition

17) Specifications by several federal agencies have become so lengthy and complex that they defeat conservation and prevent competition among experienced firms who, on that account, may refuse to submit bids.

18) Architectural and engineering firms employed by the government should be expected to furnish service of quality equal to that for private work, including responsibility and participation in selection of materials and contractors.

19) Fees for service paid by the government should be commensurate with those paid by private concerns to architectural and engineering firms.

20) Guarantees of performance in operation by completed work should be limited to one year. Excessive performance guarantees tend to increase the contractors' bids out of proportion to the possible value.

Applies Also To Private Building

In addition to the 12 pages devoted to the advisory panel on heating, ventilating, and air conditioning, the 233 page report includes sections on space and planning, general; space and planning, hospitals; building envelope and interior; structural engineering; electrical systems; plumbing; and building construction practices. There are also several appendixes — including references, surveys, standards and other source material.

Although concerned primarily with conservation in federal government building activities, much of the study applies of course to private building. The report sells for $3.50 and its title is A Study of Conservation in Building Construction. Orders should be addressed to the Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C., accompanied by a check or money order payable to the Treasurer of the United States.

[Note: The BRAB does not necessarily endorse all recommendations of the advisory panels. The study of heating, ventilating and air conditioning placed special emphasis on high pressure (125 psi) steam distribution for large building sites, and on conventional two pipe low pressure steam heating for large industrial, commercial, and residential types of buildings. The subjects of ventilating and air conditioning were only touched on to the extent indicated in the report.]

AIR LOCKS —

[*Concluded from page* 121]

of the additional component and the possibility of a resulting unsafe condition. The effect of failure of each component of the system (dampers, fans and controllers) must be studied, and, insofar as possible, provisions must be made for each component to 'fail-safe'; that is, to assume such a condition in failure that the safety features of the system will not be compromised."

With proper planning of space and processes it is frequently possible to provide a ventilation system which will insure air flow in safe directions without zone pressure control. Mr. McIntosh described such a system, which he called a series flow system.

"With the series flow system, rather high rates of air change are required to satisfy comfort conditions in the zone of final air use," he said. "Special care must be exercised to prevent drafts from supply terminals and through doors. Excessive air movement may cause the spread of contamination within the 'hot' zone or from an 'intermediate' zone to a 'hot' zone as well as personnel discomfort.

Regarding the problem of disposal of the airborne contamination after it is directed into the exhaust ventilation system, Mr. McIntosh said that, in general, the particulate matter is removed from the air stream by filters and gaseous matter is removed by scrubbing. As a further safeguard, the final discharge point of exhaust ventilation may be from a stack 200 or more feet in height.

"Despite the remarkably high efficiencies attained with filters and scrubbers, there still remains the necessity for achieving dilution and dispersal of the ventilation exhaust from certain buildings, particularly from those in which processes are carried out on a production scale," he said. "For certain processes, where such control can be arranged, it is the practice to discharge process exhaust only during those periods when weather conditions are favorable to wide dispersion and consequent good dilution of the exhaust air. Well equipped weather stations are usually maintained to supply the advance weather information required for this control."

Mr. McIntosh said an extensive program of air, dust, vegetation and wildlife monitoring over a wide area is maintained to test the effectiveness of these measures.

Repair Job Case Indicates Contractor's Responsibility

HEATING, PIPING AND AIR CONDITIONING contractors may enjoy more complete legal control of an installation or repair job — and at the same time be subject to greater responsibility — than is generally realized. That responsibility can extend to third parties who may suffer or claim to suffer, through the contractor's negligence, some form of *indirect* injury — as a recent case shows.

In the city of Pleasant Platte [all names are fictitious] much of the social life revolves around the Optimistic Owls club. Its membership comprises conservative ex-service men, and the club does not scorn to be thrifty and to have as its first floor tenant the Topstile clothing store. The club retains the second and third floors for its own use.

All went well until the club decided to have its hot water system overhauled, and for that purpose retained Conduit & Co. Scarcely had Conduit's employees left the third floor, where they had been working on a tank, when a leak developed. The water poured down through the second floor into Topstile's store, doing great damage to his stock of clothing.

Topstile sued the Owls and the club came down on Conduit & Co. with a "cross-petition". Owls-against-Conduit is the angle that interests us here.

The trial court gave judgment in favor of the club and against Conduit, who appealed. The state supreme court reviewed the evidence in a lengthy and reasoned opinion. Conduit, it transpired, had installed a hot water heater on the third floor of the building and upon previous occasions had de-limed it — the water at Pleasant Platte being traditionally hard. In so doing this time, Conduit's employees (it was claimed) replaced the plate and gasket they had removed for the de-liming process, waited about two hours, and left between 7:30 and 8:30 p.m. The club averred that one of its employees had locked the third floor doors after Conduit's men departed. An hour or so later, club members on the second floor found their activities dampened by water from the third floor, which finally reached Topstile's goods (to their damage.)

Contractor Claims Unjust Treatment

Conduit complained to the supreme court that he and his employees were treated unjustly at the first trial. Lime, he said, had formed in the safety valve or nipple and thus prevented any overflow from the heater. He declared that (a) his de-liming work did not include any attention to the safety valve; that (b) the club's lack of care resulted in a leak caused by excessive pressure; that (c) no drain had been installed; and finally (d) that his men had completed their work and left the building before the leak developed.

Manifestly, Topstile couldn't sue Conduit because he had no direct contact with him. He could only sue the Owls and the Owls in turn cross-claimed against Conduit. Exclusive control and management of the heater in question, as between the Owls and Topstile was in the Owls, the trial court had held. However, as between the Owls and the piping firm, a different situation was seen by both tribunals.

Pacing with legal Latin a further move against the hapless Conduit, the supreme court saw an "inference" as having been "permitted to the effect that the escape of water from the heater was caused by the negligence of the employees" of Conduit "in replacing the plate and gasket." This view was strengthened by the fact that no one had entered the third floor after Conduit's men had left.

In support of such conclusions, the court cited a somewhat similar case from another state's judicial records. There, a power and light company had installed an electric range in the plaintiff's home. Two weeks later the plaintiff's wife, removing some rolls from the oven, was injured when she turned off the switch and a "charge of electricity" flared up in her face. "Reason," said the judge, "permits the inference that it must have been the defendant who was negligent, for fault cannot be traced to any other party."

In our case, the state supreme court took off from there: "And so" in the present case "we have concluded" that the lower court "was justified under the evidence in finding" that Conduit, "acting through his employees was in control of the heater at all times material to this litigation." The trial court was likewise justified in drawing the inference that it must have been the piping firm's "employees who were negligent . . . in replacing the plate and gasket in the front of the heater . . . This is particularly true" because under the evidence the court found that no employee of the club was on the third floor to change the gage on the heater.

"Passive" and "Active" Negligence Involved

In appealing from the lower court's decision, Conduit's lawyers contended that he should never have been made a co-defendant and that there was no substantial evidence of any negligence on his part resulting in an escape of water from the heater. Here, again, the piping firm was loser, for the supreme court applied the principle of "passive and active negligence". In this case, the negligence of the club was held to be *passive* but the negligence of Conduit was deemed *active*. Therefore, he was the one who, in the final analysis, had to pay.

[Note: While this discussion applies to an actual case, it should be remembered that legal rules vary in different states.]

William Hurd Hillyer, author of this article, is a contributor to a number of banking and financial publications and has written several books on business. A former vice president of the Atlanta Trust Co., his work there gave him a practical legal background.

Heating, Piping & Air Conditioning

THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

JOURNAL *SECTION*

Development of the Thermal Conductivity Probe

By F. C. Hooper* and S. C. Chang**, Toronto, Ont., Canada

SUMMARY — The thermal conductivity probe, an instrument for the determination of the thermal conductivity of solids by transient heat flow observations, was developed at the University of Toronto and originally reported upon in 1950.[1] The present paper reports further work and operating experience, and outlines a more generally satisfactory method for the computation of the probe readings.

A TRANSIENT heat flow apparatus for the rapid determination of the thermal conductivity of solids has been under development at the University of Toronto for several years. In an initial paper[1] the apparatus was described, and the technique of its use and the history of its development were outlined. Since that time the probe has found application in several laboratories and in many field investigations. Research and development work has continued at Toronto.

The present paper will make available some of this experience in application of the probe and present a newly developed chart for the graphical evaluation of thermal conductivity from the probe readings.

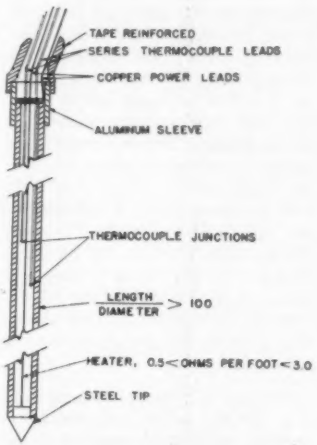


Fig. 1—The standard form of thermal conductivity probe

Application Experience

The thermal conductivity probe is basically a linear heat source of constant strength which can be inserted in the material to be tested. The time and temperature rise relationship can be determined and used for the evaluation of the thermal conductivity of the surrounding material.

Many forms and sizes of the instrument have been used, but the construction and dimensions described in the original paper, as shown in Fig. 1, have proved to be generally satisfactory where test specimens of suitable size are available. This form of the instrument is now regarded as standard.

Experience has revealed the importance of several practical considerations. Mechanically, a weak point exists at the point of flexure where the leads leave the probe, and re-inforcement of this position by elastic binding tape or other means is necessary if short-circuits and leakages are to be avoided. Care must be taken

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[1]Transient Heat Flow Apparatus for the Determination of Thermal Conductivities, by F. C. Hooper and F. R. Lepper (ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, August 1950, pp. 129-134).

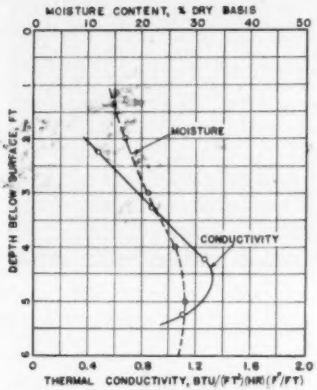

Fig. 2—Moisture and conductivity variation with depth in an undisturbed sandy soil

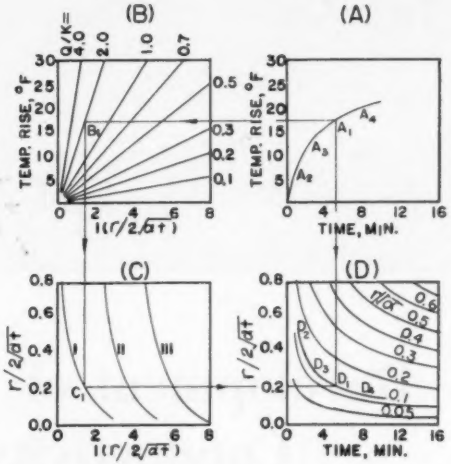

Fig. 3—Graphical presentation of the mathematical line heat source relationship

to avoid the use of lead-in wire of heavier gage than necessitated by the electrical requirements, since a considerable conduction error due to end loss can arise in specimens of low conductivity. Care should also be exercised in installing the heater wire to avoid local straining with its consequent non-uniform heating. When storage batteries are used as a source of power as in portable forms of the instrument, it is important to provide sufficient capacity to avoid progressive voltage drop and the consequent progressive fall in heat source strength over the period of the test.

The standard probe has been used in materials ranging from dense moist clay to rock-wool fiber insulating material of very low density. No lower limit to measurable thermal conductivity has become apparent, but an upper limit is imposed by the sensitivity and speed of the temperature measurement system employed, since temperature rises become smaller and significant time intervals become relatively shorter as conductivities rise. Moreover, deviations from ideal behavior are more significant at short time periods.

Several special forms of the probe have been developed for specific uses. A small probe, 4 in. in length and 0.060 in. in diameter, suitable for use in small specimens, was built and applied in measurements on dairy products. The minimum size of probe is apparently restricted only by the craftsmanship required in the construction of probes of adequate length to diameter ratio with small overall lengths.

In undisturbed ground the moisture content, and consequently, the conductivity, vary considerably with depth. A special form of the probe has been used in the advance exploration of the projected routes of heated oil pipe lines and buried electric cables, and in the testing of heat pump ground coil sites. These probes are 5 to 8 ft in length and of stainless steel tubing approximately 3/8 in. in diameter. Thermocouples are placed at intervals of about 1 ft over the length and are read separately and simultaneously. Conductivities are calculated separately for each thermocouple position. The probe is driven vertically along a path prepared by driving and pulling a hardened steel rod of the probe diameter. Fig. 2 shows typical values taken at a heat pump site.

At least two special factors enter into this application, both due to the vertical variation of properties in the soil. Since there is a temperature gradient with depth over the length of the probe, some longitudinal conduction must take place in the probe wall. Moreover, the heat flow from the probe is not entirely in a radial plane because both the soil temperature and conductivity vary with depth. Both of these effects must introduce errors. Fortunately high precision is not normally required in this type of measurement, and the values obtained from it are apparently satisfactory for the purposes mentioned.

In the laboratory, considerable work has been done using a single straight wire, not covered by a tube, as the heat source, with thermocouples mounted on or near the wire. This simple device, while only suitable for laboratory work, gives satisfactory results in moderately homogeneous material, and is particularly sensitive in very low density specimens.

Typical results from tests on various materials with several forms of the probe are shown in Table 1. It will be noted that the range of variation of the thermal conductivities measured was more than fifty-fold. In this table the significant time shown indicates period of observation used in the computation of the result.

Method of Analysis

The temperature rise of an infinite line heat source of constant strength and zero diameter in an infinite, initially isothermal, homogeneous specimen is given by Equation 1:[1]

$$\theta = \frac{Q'}{2\pi k'} \int_{rn}^{\infty} \frac{e^{-\beta^2} d\beta}{\beta} = \frac{Q'}{2\pi k'} I(rn) \quad \text{----(1)}$$

where

- k = Thermal conductivity, Btu per (hour) (square foot) (Fahrenheit per inch).
- k' = Thermal conductivity, Btu per (hour) (square foot) (Fahrenheit degree per foot).
- n = A function $1/2(\alpha t)^{\frac{1}{2}}$
- Q = Heat input per unit length, watts per foot.
- Q' = Heat input per unit length, Btu per (hour) (foot).
- r = Radial distance of the position of temperature measurement, feet.
- t = Time elapsed from start of heating, hours.
- $I(rn)$ = A function,

$$\int_{rn}^{\infty} \frac{e^{-\beta^2} d\beta}{\beta}$$

- α = Thermal diffusivity, square feet per hour.
- β = An integral parameter.
- Θ = Temperature rise after start of heating, Fahrenheit degrees.

It is apparent that an actual probe cannot behave in exactly the manner of this ideal line heat source. The probe is finite in diameter and length, and is not homogeneous throughout its cross-section. It is made of a different material than the test specimen. Moreover, temperature is measured by a finite thermocouple, and the precise position at which it measures temperature is not determinable.

While it is possible to compensate by direct mathematical methods for some of the foregoing deviations, such as for finite probe diameter, other factors such as non-homogeniety of the probe, are not susceptible to direct mathematical treatment. Adjusting mathematically for some of the deviations only does not necessarily yield a better approximation, since these may be compensated, or even over-compensated, by the remaining factors. Failure to appreciate this can lead to invalid conclusions.

There are at least two effective methods which permit allowance for the non-ideal behavior of the actual probe without abandoning the simple line heat source assumption. Originally a time scale adjustment method was used. This method is given in detail in the original paper.[1] Further examination of the problem has since indicated that adjustment of the assumed position of temperature measurement will yield results which are at least as reliable. In practice the latter has proved to be a much more convenient method of adjustment.

Both of these methods have the effect of adjusting the lower limit of the integral in Equation 1. Time adjustment alters n which is a function of time. Position adjustment alters r, the assumed radius of the temperature measurement.

The method of introduction of the radius adjustment becomes apparent when the relationships which follow are considered.

The value of θ from Equation 1 can be obtained for any corresponding value of (rn). A series of such values may be chosen and a family of linear lines of slope $Q/(2\pi k)$ is obtained when plotted as in Fig. 3 (B).

Variation of $I\ (rn)$ with (rn) can be shown graphically as in Fig. 3 (C).

Further, the variation of (rn) with time can be shown for all values of the parameter $r/\alpha^{\frac{1}{2}}$, as in Fig. 3 (D).

The observations of temperature and time made during an actual probe test can be plotted as in Fig. 3(A).

If the value of Q/k is known, then for any point A_1 on the test curve there is corresponding temperature rise from which may be obtained the corresponding values of $I(rn)$, and consequently of (rn) and of $r/\alpha^{\frac{1}{2}}$, shown in the sequence of operations A_1, B_1, C_1, D_1 in Fig. 3. Repeating this sequence for points A_2, A_3, A_4, etc. will give a corresponding series of points D_2, D_3, D_4, etc. on Fig. 3 (D).

If a suitable value of Q/k has been chosen, and if the assumption of radius adjustment is justified, then a curve of constant $r/\alpha^{\frac{1}{2}}$ must be obtained. This is indicated by a curve conforming to the contours of the Fig. 3(D) lines.

For convenience the four charts of Fig. 3 can be superimposed to form a single chart as in Fig. 4.

In using this method of solution it is necessary to select arbitrarily a value of Q/k and then proceed by successive approximation. For example in Fig. 5, for the test curve as seen in the figure, a value of $Q/k=3$ was chosen, and yielded curve (a), which proved too shallow. Curve

Table 1—Typical Results from Probe Determinations

Material	Density lb/cu ft	Type of Probe	Base Temp of Specimen F deg	Overall Temp Rise F deg	Significant Time Min	Conductivity[a]
Silica aerogel	4.55	12 in. long, 3/32 in. dia., brass tube	75	22.5	4.5	0.125
Rockwool	10.2	12 in. long, 3/32 in. dia., aluminum tube	78.1	25.1	7	0.265
	10.2	17.5 in. long single 24 Ga. wire with thermocouple attached	72.4	18.3	6	0.267
Corkboard	10.0	Single 24 Ga. wire laid between two boards	71.8	22.3	5	0.290
Saw dust	11.0	12 in. long, 3/32 in. dia., brass tube	63.3	20.8	7	0.290
Wheat	33.0	7.5 in. long, 3/32 in. dia., aluminum tube	73.2	14.4	5	0.926
Butter	62.3	7.5 in. long, 3/32 in. dia., aluminum tube	38.4	8.8	5	1.37
Margarine	62.4	Single 24 Ga. wire, with thermocouple attached	39.9	8.1	5	1.62
		Single 24 Ga. wire, with thermocouple offset ⅛ in.	45.6	2.3	5	1.61
Sand	100.7 1.38% moisture	12 in. long, 3/32 in. dia. probe, with 3 thermocouples in series	71.5	40.7	8	3.01
Humus Soil	15.7	12 in. long, 3/32 in. dia. probe, with 3 thermocouples in series	76.6	27.5	7	3.62
Concrete 1:2:2 mix	2 days old	12 in. long probe, 3/32 in. dia., cast into specimen	82.8	26	5	10.6
	19 days old		71.4	35.4	6	7.71
	31 days old		68.4	42	6	7.06

[a]Btu per (square foot) (hour) (Fahrenheit degree per inch).

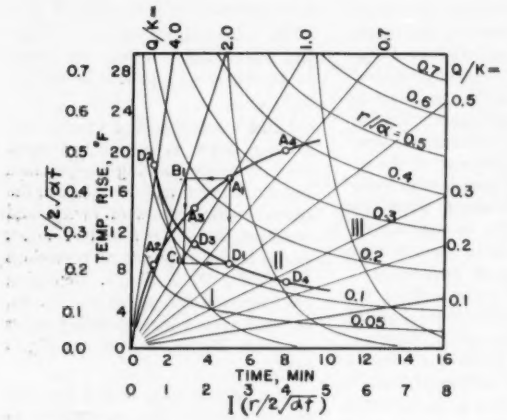

Fig. 4—Compound chart obtained by superimposing the curves of Fig. 3

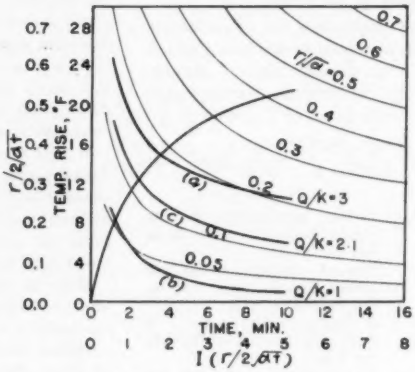

Fig. 5—The solution of a typical problem on the chart

Table 2—The Non-constancy of the Equivalent Radius

Material	Conductivity Btu/(hr) (sq ft) (F deg/ft)	Density lb/cu ft	Specific Heat Btu/(lb) (F deg)	Diffusivity α, sq ft/hr	$\frac{r}{\sqrt{\alpha}}$	r ft
Silica aerogel	0.0104	4.55	0.20	0.0114	0.12	0.0128
Saw Dust	0.0243	11.0	0.40	0.00545	0.08	0.00592
Sand	0.223	95	0.20	0.0117	0.0066	0.000713

(b), for the second chosen value of $Q/k = 1$, proved too steep. A final choice of $Q/k = 2.1$ gave line (c), which conforms very closely to the contours. Since the value of Q is known from the experiment, the value of k has thus been determined as $Q/2.1$.

The precision of reading is reduced when the $r/\alpha^{1/2}$ line obtained lies close to the axes. To permit equal precision in the use of the chart (Fig. 4) over a wide range of values of Q/k, three lines I, II, and III, showing the $r/2(\alpha t)^{1/2}$ function, have been provided. Actually, curve I corresponds to the scale values of $r/2(\alpha t)^{1/2}$ and $r/\alpha^{1/2}$ shown, while curves II and III correspond to scales expanded by factors of 10 and 100 respectively. In any problem the most appropriate of these lines is chosen. Since only the constancy of the $r/\alpha^{1/2}$ function is sought, the change from one of these curves to another does not alter in any way the procedure already described.

The 30 deg temperature rise range of the ordinate scale is convenient for most tests. Where temperature rises are too great or too small to be plotted conveniently to this scale, the temperature rise scale can be adjusted and the Q/k scale will be altered in the same proportion. That is, if the temperature rise scale is reduced by a factor of 2 to give a full scale value of 60, then the Q/k values will be altered by the same amount, so that $Q/k = 7$ would be read $Q/k = 14$.

For convenience in the practical calculation of probe results, the values of Q/k shown are expressed in terms of Q in watts per foot of probe length and k in Btu per (hour) (square foot) (Fahrenheit degree per inch).

Fig. 6 shows the chart, which is of the same form as Fig. 5, but of sufficient size and detail for use in actual calculations.

Significance of Chart Values

The chart method, by reducing the solution to depend upon the constancy of the $r/\alpha^{1/2}$ parameter, and not upon actual values of r and α, eliminates the difficulty found in assigning a value to r. The method, in effect, makes the determination at the most suitable value of r for a particular test condition.

The basic premise is, that if a constant value of $r/\alpha^{1/2}$ can be obtained by this graphical method, then it follows that the test curve can be correlated closely by Equation 1. That is, the value of Q/k is uniquely determined by this means.

Thus, the applicability of the method depends upon whether or not a constant $r/\alpha^{1/2}$ value can be obtained. A considerable number of determinations, such as those for the tests shown in Table 1, indicate that a very nearly constant $r/\alpha^{1/2}$ can be found. Moreover, it has been found that thermal conductivities of dry materials determined by this method agree well with values obtained on the hot plate apparatus.

If the method is not applicable under certain test conditions, or if observations have been incorrectly made, a constant $r/\alpha^{1/2}$ will not be obtainable. Thus, improper application is automatically avoided.

It should be noted that the value of r in the parameter $r/\alpha^{1/2}$ does not coincide with any fixed physical position in relation to the probe. This is an equivalent mathematical value only, and varies greatly with test conditions and materials. It is therefore not possible to use the $r/\alpha^{1/2}$ value found from the chart for the determi-

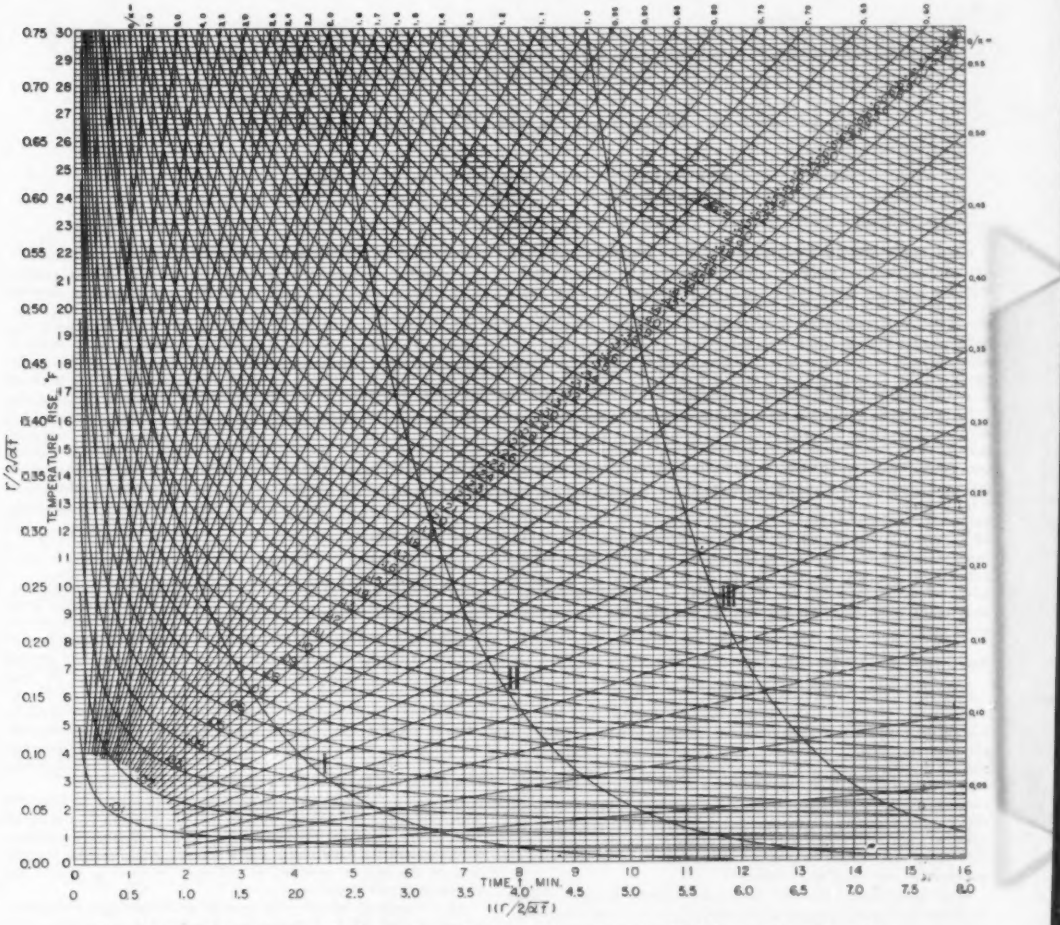

Fig. 6—A working chart to facilitate the evaluation of thermal conductivity from probe observations

nation of α, because the value of r cannot be known. This non-constancy of r can be seen in the results shown in Table 2, which was constructed from test results from the same probe used in three quite different materials of known physical properties. The k values and $r/\alpha^{1/2}$ values shown were obtained by the chart method, and the r values calculated by substituting the known value of α. It will be seen that r is by no means constant for the same probe.

Conclusion

The practical utility of the instrument has now been demonstrated under a sufficient range of conditions to warrant the statement that the device is no longer of experimental interest only, but is a practical tool available for direct engineering application. The chart method of calculation described here greatly facilitates the computation of results and increases the reliability of the method.

Acknowledgment

Most of this work has been carried out in the Heat Transfer Laboratory at the University of Toronto. The financial assistance of the University School of Engineering Research and of the National Research Council at Ottawa is gratefully acknowledged.

The authors wish also to acknowledge the contributions to the research and development work made by Messrs. C.P. Lentz, J.G. Takata, G.R. Masson, and F.R. Lepper.

'52 Heat Waves Stress Value of ASHVE Research

By I. W. Cotton, Chairman, Committee on Research

The summer of 1952 *may* not have broken *all* previous records for continuous hot weather — but it has certainly set new marks in many parts of the country for daily maximum and mean temperatures. It has provided ample — in some cases, very unfortunate — demonstrations of the effects of severe weather on health and efficiency, and has pointed up to a considerable degree the role which this Society plays in alleviating physical and physiological stresses resulting from exposure to conditions outside the usually accepted limits of comfort.

Perhaps in no other period of similar length have there been so many important demonstrations of the part that air conditioning can play in our public and private lives — in our homes, our offices and our places of public assembly. The national political conventions in July gave ample evidence that air conditioning is firmly established as a "must" for all important places of public assembly. The vast increase in 1952 in the sale of packaged air conditioners and room coolers showed the public interest in home and office applications. A great many people learned by personal experience this year of some of the great advances made by members of this Society in developing ways and means to increase human comfort by control of atmospheric environments.

Society's Work Developed the Effective Temperature

Everyone who has been a member of the ASHVE for any length of time knows something of the Society's early work on comfort standards for winter and summer. These tests determined the limits of indoor temperature and humidity within which normally clothed, healthy people felt comfortable. The concept of Effective Temperature was established by this work, which was followed later by studies made with groups under various degrees of activity and different climatic conditions. For years, the ASHVE comfort standards have found general acceptance both here and abroad.

One well-known medical authority recently wrote — after studying the Society's work in the field of comfort and physiological adjustments to environmental conditions — that "It seems to me that the engineers were most fortunate in selecting the zone of comfort as a guide for design, although some engineers were dissatisfied with this guide because it was based on subjective reactions for which they had not satisfactory definition and would prefer to use a measurable physiological criterion. Comfort appears to represent an integration of many physiological processes and the value of the answer should not be discounted because one does not understand all the equations used in its derivation."

Those who attended or read the reports of the symposium on Man and His Relationship to Air, held during the ASHVE's meeting in Philadelphia in January of last year, will remember the valuable reviews made by such recognized authorities as Dr. DuBois, Dr. Keeton, Mr. Leopold, and Professor Hatch, and the excellent summary given by Professor Glickman.

The papers presented at that meeting outlined the progress made by the Society in studying and trying to understand the physiological aspects as well as the engineering aspects of heating, ventilating and air conditioning. They told of the role which air conditioning has played in the treatment and prevention of disease and presented suggested standards for industrial heat control. Available in pamphlet form, they deserve careful study by all those called upon to design air conditioning installations and equipment to serve the needs of comfort and of health.

Continued research into the role which the atmospheric environment — and, particularly, sudden changes in it — plays in the physiologic adjustments which both healthy and physically impaired persons can and do make, has for many years been an important part of the Society's research program. During the past four years it has been possible to extend these studies, because the National Institutes of Health of the Federal Security Agency joined with the Society in sponsoring the work carried on at the College of Medicine of the University of Illinois in Chicago under one of our distinguished medical members, Dr. R. W. Keeton, who now serves on our Committee on Research.

Now We Must Learn of Radiation's Effects

The original ASHVE comfort chart assumed a relative "symmetry of radiation." In other words, there was no very great difference between the surface temperature of one part of the surroundings and any of the others. The present trend toward the use of the floor or the ceiling of a room as a heating surface emphasizes the desirability of a study of the effect of such conditions on comfort. Such a study is planned and is on the program of the Committee on Research. For it, we shall be able to use the new Environment Laboratory which, previously described in these columns, is now being used on a two-shift basis for studies under the direction of our Technical Advisory Committee on Panel Heating and Cooling.

The Technical Advisory Committee on Sensations of Comfort, under the chairmanship of Charles S. Leopold, has drawn up its preliminary plans for continuing our studies of sensory reactions to environmental conditions and is eagerly awaiting the completion of the present program in the new facilities so that it can get its program under way.

The Technical Advisory Committee on Physiological Research, of which Prof. M. K. Fahnestock is Chairman, has a distinguished membership of medical doctors, physiologists and engineers. It includes representatives of the Armed Services and has corresponding members in foreign countries so that the Society, through this committee, is kept closely in touch with physiological research in all fields and other lands.

You and I Are Contributing

As Dr. DuBois said at the Philadelphia meeting, "The human body has to be variable if it expects to cover the earth from the Arctic to the Equator." The ASHVE Committee on Research, through its various Technical Advisory Committees and the programs under way and planned in its own Laboratory and in cooperating institutions, is developing the information which will enable our profession to meet the requirements of comfort and health from the Arctic to the Equator.

As members of the ASHVE, and therefore partners in this research work, you and I are contributing effectively to the development of our profession and its allied industries, and to the ultimate health, comfort and happiness of the public we serve.

Design Factors for Vacuum Cleaning and High Pressure Pneumatic Conveying Systems

By K. J. Caplan*, St. Louis, Mo., and R. L. Stephenson**, New York, N. Y.

SUMMARY — Vacuum cleaning systems are useful tools wherever housekeeping involving dry or dusty materials is a problem, whether for reasons of health, food sanitation, economy, or for other specialized reasons. A properly designed system permits rapid and thorough cleaning without re-dispersal of the dust, and provides pneumatic conveying of the collected material to a central point convenient for disposal. Piping practices are different than for most other fluid-handling jobs, and design data are out of the range usually presented in papers on air-handling. Such data and design practices, some of which are the result of practical field experience rather than theory, are accordingly presented here. Information on design data and practice for high-pressure pneumatic conveying systems is also included.

THE DESIGNER of the industrial vacuum cleaning system, or of the closely allied high-pressure pneumatic conveying system, has relatively little published information to use as a guide. Yet the proper design and functioning of a vacuum cleaning system is important; all too frequently, the entire capital investment in the system is wasted because it works poorly or gives frequent trouble, with the result that its use has been abandoned by the workers. The necessity for correct design and operation of a pneumatic conveying system is obvious, especially if it is an integral part of the production process.

Vacuum cleaning systems are useful tools wherever housekeeping involving dry or dusty materials is a problem, whether for reasons of health, food sanitation, economy, or for other specialized reasons. A properly designed system permits the clean-up operation to be just as rapid as sweeping and much more thorough. It eliminates the raising of dust clouds and the redeposition of dirt during the operation itself, and provides pneumatic conveying of the accumulated material to a central point convenient for disposal. In addition, there are many specialized applications where an operator may use a vacuum pick-up almost constantly during his work; for example, in removing excess enamel frit from signs after the frit has been scraped loose and before the signs go to the baking oven. One word of caution, however; no vacuum cleaning system, however well designed, can be expected to handle trash such as shop towels, long splinters, welding rod ends, etc.

High-pressure pneumatic conveying systems, if well designed, obtain dust-free and trouble-free handling of dry materials. Although the power consumption is higher than with mechanical conveyors, the pipes are small and can be run in any direction, around bends, and in crowded locations, with much more convenience than with most mechanical conveyors. No accessory dust-collection hoods and ductwork are needed as no dust escapes from the piping. The dust-free aspect is sometimes quite important, for example, when unloading bulk material by hand. Low pressure, high volume pneumatic conveyors have the same general advantages, except that the piping and dust collection equipment must be considerably larger in order to handle the larger air volume; on the other hand, the fans used are usually less expensive than the high-suction multistage compressors or the positive displacement blowers used for high-pressure pneumatic conveying. Since the design problems and data used for low pressure work are not too closely allied to vacuum cleaning systems, low-pressure pneumatic conveying will be omitted in further discussion.

Vacuum Cleaning Systems

Sizing System

The first and one of the more important steps in design is estimating the number of vacuum inlets that will be in operation at any one time. (This number is not to be confused with the total number of inlets of the system, which latter number is selected on an entirely different basis. See Layout of System.) A good estimate here is essential, since too small a system obviously will not satisfy the peak demand, whereas too large a system causes an unnecessary expense.

No hard and fast design rules exist for this first step. The decision is the result of estimate and judgment on the part of the designer.

Questions to be considered are:

1. What is the number of workers likely to be free to use the system at any one time?
2. Is it the practice for the whole shift to turn-to at the end of the shift and clean-up and is it desired to retain this practice even at the expense of a larger vacuum system?
3. What is the minimum number of workers required to do the clean-up job in the desired time?

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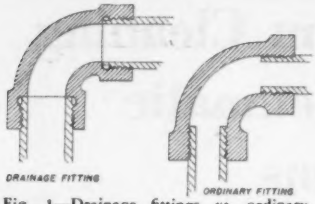

Fig. 1—Drainage fittings *vs.* ordinary fittings

4. How many workers will be using an inlet more-or-less constantly?

Such questions can be answered only by discussing the situation thoroughly with someone familiar with the details of plant operation. Table 1 provides some assistance in estimating cleaning requirements.

Sizing Tools and Hose

Industrial vacuum cleaning tools and hose are normally available in three sizes, 1, 1½ and 2 in. nominal diameter. Piping systems are usually designed for use of only one of the available tool diameters, and if properly designed, assure satisfactory operation under these conditions. Attempts to use tool sizes either smaller or larger than called for by the piping design are likely to meet with failure unless the available suction, pipe velocities, and operating conditions have first been estimated and found satisfactory. A guide for selecting hose and tool sizes is shown in Table 2.

Although the larger tools exhaust larger air volumes, will pick up and convey material more rapidly, and cover a larger area, some of these advantages are offset by their greater weight and awkwardness. For example, a 50-ft length of 2-in. hose is so cumbersome and heavy to handle that it is normally used only for heavy deposits. It is usually better to provide extra suction to assure maximum efficiency with the 1½-in. tools than it is to revert to the use of 2-in. accessories. One-inch I. D. vacuum cleaning hose and tools should only be used for such applications as assembly bench cleaning (replacing compressed air) or for chip or dust removal from production machinery such as a milling cutter or drill with vacuum attachment. The standard 1-in. vacuum hose is 8 ft in length.

Table 1—Average Work Rates for Floor Vacuum Cleaning, (Using 1½ in. ID Hose and Tools)

	Cleaning rate, sq ft per hour	
	Stationary System	Portable Unit
Smooth floor, minimum of obstruction	2500-3500	2000-2500
Rough, obstructed floor	1500-2500	1000-1500

Vacuum cleaning hose and tools of 1½-in. size are used for the greatest majority of general plant cleaning including floors, walls, overhead surfaces and equipment, since this size provides the maximum dust removal capacity consistent with ease of handling. The standard 1½-in. vacuum hose is 25 ft in length and where the areas are unobstructed it is common practice to couple two lengths together so as to provide a 50 ft cleaning radius from each vacuum connection. In congested areas, particularly if frequent cleaning is required, it is better to provide sufficient vacuum connections to permit the use of the 25-ft lengths exclusively.

Two-inch vacuum hose and tools are normally used only for floor cleaning or for removing heavy deposits such as might be found in a conveyor pit. They are seldom used for wall or overhead cleaning because they are so cumbersome as to actually slow up the work because of restricting the operators' movements. The standard 2-in. I. D. vacuum hose is 25 ft in length and two or more lengths may be coupled together as circumstances require.

Layout of System

After the maximum and minimum number of sweepers to be in simultaneous operation is determined, the next two most important considerations are the location of the dust separators and vacuum inlets.

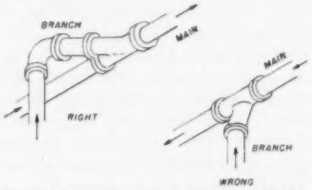

Fig. 2—Branch entry into horizontal main

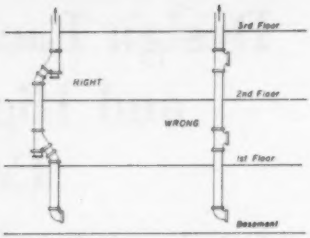

Fig. 3—Branch entry into vertical main

The dust separator should always be located so as to provide for convenient disposal of the accumulated dust, thus saving re-handling labor. These separators should also be located as centrally as possible to the general piping layout and if it is practicable to place them on one of the lower floors of the building, this simplifies the piping layout and effects a saving in the cost of the piping.

The number and location of the vacuum inlets should be considered carefully so as to provide the simplest and most economical piping layout consistent with maximum cleaning efficiency. Careful planning and competent advice at this stage results in a better system at lower cost.

Vacuum inlets should be spaced so that all desired areas can be reached easily from a convenient inlet. Standard hose lengths are 25 ft. It is practicable to couple two 25-ft lengths together to reach 50 ft. For congested areas and where frequent cleaning is required, inlet valves should be spaced to permit the use of 25-ft hose lengths, thus keeping cleaning labor to a minimum. In open areas the inlet valves can be spaced to provide for the use of 50-ft hose lengths, and in some cases even longer.

Table 2—Suitability of Hose and Tool Sizes

Nominal Size Inches	Floor Cleaning	Close Hand Work	For Handling Heavy Spills	Overhead Vacuum Cleaning	Normal Hose Lengths Feet	Sex of Workers
1	Not used	Yes	Inadequate	None	8	M or F
1½	Fast	Yes	Adequate	Preferred	25 and 50	M or F
2	Fast	No	Preferred	Poor	25 and 50	M

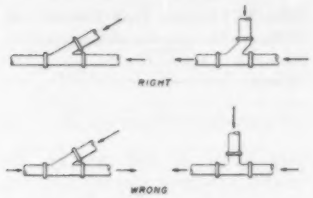

Fig. 4—Proper use of Y-branches

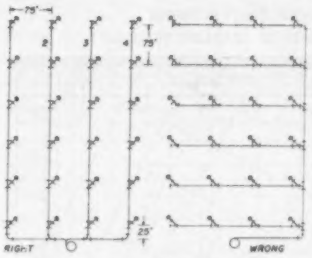

Fig. 5—Layout of mains

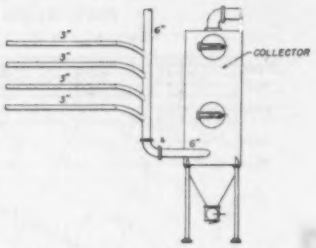

Fig. 6—Entry of independent mains to header at collector

The planning and spacing of inlets requires vertical dimensioning also, if any work is to be done which cannot be reached from floor level by 6-ft extension handles for the usual cleaning tools.

Piping Layout

The layout of the piping system requires care to prevent settling out of solids which may plug the system. Since the piping practices are somewhat different than for conventional piping systems, rather complete drawings showing typical connections are desirable, and close supervision of the installation is necessary.

Ordinary Schedule 40 pipe is commonly used, with cast iron drainage fittings (pitched fittings are not necessary) to eliminate the material traps and ledges formed by the use of ordinary pipe fittings (Fig. 1). Welded piping or tubing systems have also been successful but care must be taken to furnish adequate clean-out plugs.

Branch lines should always enter a main line horizontally or from above; never from below (Fig. 2). Branches entering from below will fill up, when not in use, with solids settled out of the flow in the main.

Mains through which the flow is vertically upward with branches or inlet valves connected at different elevations should be offset at each such elevation as shown in Fig. 3; otherwise, the vertical leg below a branch which is being used will fill with solids.

Long-turn Y-branches, 45 deg and 90 deg, should be used rather than Tees (Fig. 4); and of course the direction of flow in the Y-branches should be in the streamlined direction.

If the layout is made for a tall building with the mains running mostly in the vertical direction, the dust collector and vacuum producer should be located at a low elevation in order to allow gravity to aid in conveying material and keeping the lines free of plugs. If the mains are largely horizontal, it is preferable to run intermediate-sized mains all the way to the dust collector (Figs. 5 and 6) rather than leading the branches all to one large, common main. In this way, conveying velocities are maintained in the mains even though only a few inlets are open and the air-flow is only a fraction of the rated load.

Selection of Velocities and Pipe Sizes

The theoretical approach to pipe sizing is of little help in designing a vacuum cleaning system. If the designer establishes some minimum velocity for conveying the material the system is to handle, and attempts to size the piping on that basis, he will find that if velocities are adequate with the minimum number (one) of inlets open, they will be prohibitively high, with corresponding excessive pressure drop, when several inlets on the same main are open. Fortunately, such systems are not as sensitive to settling of solids as the ordinary dust collecting system, primarily because the suctions are much greater. Thus, if some material does settle out in a long horizontal run when air velocities are low, the material will be picked up again when more inlets are opened. These systems are, to an extent, self-unplugging; but if once the air flow is completely stopped by a solid plug, the system will be quite unlikely to unplug itself.

The practical approach to the velocity-pipe size problem is to select a pipe size to give an air velocity somewhat less than the usual conveying velocity when only one branch is open. The main, so sized, is then used to connect to other branches only in such numbers and in such locations that the maximum number of branches *likely to be open at one time* on this main will not result in prohibitive velocities of 9000 fpm or more. Additional branches over and above this maximum are connected into other mains that run all the way to the dust collector (Figs. 5 & 6). Table 3 shows the usual

Table 3—Conveying Velocities, Feet per Minute, in Vacuum Cleaning and Pneumatic Conveying[a]

Nominal Pipe Size Inches	Vertical Risers		Horizontal Mains	
	Min[b]	Max[c]	Min	Max
1-¼	2400	3500	1700	2800
1-½	2600	3800	1800	3000
2	3000	4200	2000	3500
2 ½	3200	4700	2200	3900
3	3800	5100	2400	4200
4	4200	6000	2800	4900
5	4800	6500	3000	5400
6	5000	7200	3400	6000

[a]Use maximum column for conveying work; it is practical under certain conditions to exceed the velocity shown as maximum.
[b]Light or easy-to-handle materials.
[c]Heavy or hard-to-handle materials.

Table 4—Usual Minimum[a] and Maximum Number of *Active* Inlets on One Main

Hose and Tool Size In.	Main Pipe Size (Inches)															
	1-¼		1-½		2		2-½		3		4		5		6	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
1	1	1	1	2	2	4	2	5	3	8	6	15	8	20	12	30
1-½	—	—	—	—	1	1	1	2	1	3	2	6	3	10	6	15
2	—	—	—	—	—	—	1	1	1	2	2	3	2	5	3	8

[a]The minimum is to be observed as carefully as the maximum.

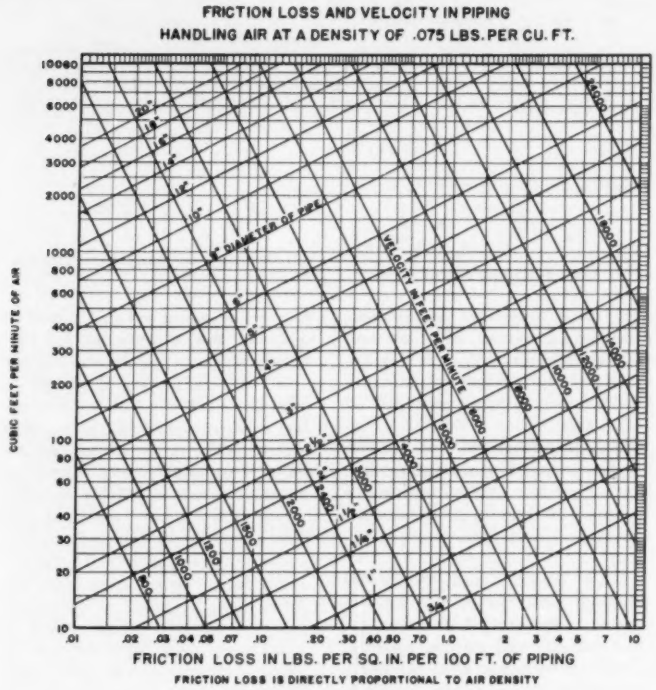
FRICTION LOSS AND VELOCITY IN PIPING
HANDLING AIR AT A DENSITY OF .075 LBS. PER CU. FT.
CUBIC FEET PER MINUTE OF AIR
DIAMETER OF PIPE
VELOCITY IN FEET PER MINUTE
FRICTION LOSS IN LBS. PER SQ. IN. PER 100 FT. OF PIPING
FRICTION LOSS IS DIRECTLY PROPORTIONAL TO AIR DENSITY

Fig. 7—Loss in piping

range of velocities satisfactory for vacuum cleaning service. It is not recommended that velocities lower than shown be used; however it is practicable under certain conditions to exceed the velocity shown as maximum. Table 4 is constructed from Table 3 as a ready reference table for laying out the usual types of vacuum cleaning systems.

Table 5 shows the *nominal* or *normal* air volume exhausted by each open hose or tool of the various sizes, and represents the volume to be exhausted from each such tool in order to secure satisfactory operation. Of course the actual volume exhausted through a tool depends on the suction applied, as well as on the detail of the tool design. The volumes listed here are basic for design and are the volumes which the system should be designed to achieve. When the system is being used below its full capacity, the volume exhausted through any one tool may be considerably greater than tabulated.

Table 5—Tool and Hose Exhaust Volumes

Nominal Size	Nominal exhaust, cfm	Practical operating range, cfm
1	50	40-60
1½	80	70-100
2	160	130-180

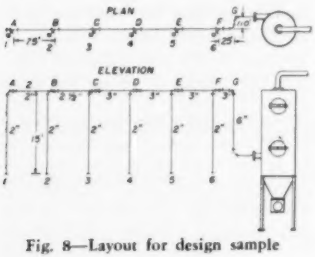

Fig. 8—Layout for design sample

Estimating Pressure Drop

Pressure drop through the piping system, dust collector, and discharge piping should be calculated for each main separately, and under the maximum condition of flow. (See Selection of Velocities and Pipe Sizes). The total pressure drop through the system is the total of the following resistances: (*a*) Suction at tool (entry loss). Negligible for open tool or open hose end; (*b*) Friction loss in hose; (*c*) Friction in straight pipe; (*d*) Losses in pipe fittings (usually expressed in equivalent length of straight pipe); (*e*) Loss through dust collector; (*f*) Loss through inlet and discharge pipes of vacuum producer (usually negligible because the diameter of this piping is usually very large compared to the conveying piping).

The design data for estimating these losses is contained in Fig. 7 and Table 6. Multiply the friction loss in pounds per square inch by 2.036 to get the corresponding value expressed in inches of mercury.

It is not possible to design a *balanced* vacuum cleaning system (as is frequently done in local exhaust

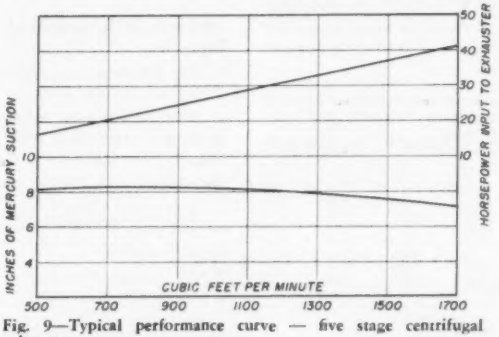

Fig. 9—Typical performance curve — five stage centrifugal exhauster

system practice) because both the amount and location of the load is highly variable. Therefore pressure drop calculations are always started with the inlet most remote from the dust collector and as branches from open inlets enter the system the volume of the added branch is added to the flow. The branch volume to be added is obtained by calculating the pressure drop, inlet to main, on the basis of the nominal volume for the inlet. The actual volume through the inlet is computed from the approximate relationship,

$$P_c/P_a = (V_n/V_a)^2$$

where

P_c = the calculated pressure drop, end of hose to main.
P_a = the actual suction pressure in the main at the point of junction.
V_n = the nominal volume of the inlet.
V_a = the actual volume of the inlet.

A design example based on Fig. 8 will aid in clarifying this procedure.

Design Example

Assume a large, single-story building with columns on 25-ft centers. The vacuum cleaning task is such that 50-ft lengths of 1½-in hose will be satisfactory. Because it is desired to place the vertical risers along columns, and the floor space is crowded so that hose lines will not have an effective use radius of 50 ft, inlet valves are spaced at 75-ft intervals at columns. One of several lines is shown schematically in Fig. 8. The entire plan sketch is shown in Fig. 5.

Assume that investigation reveals that no more than 10 workers are likely to be using a vacuum inlet at any one time. On the other hand, it is quite likely that only one worker may be using an inlet. Because the distribution of workers using the system is random at all times, it is unlikely that more than four inlets on one main will be in use simultaneously. It is advantageous, from space and disposal considerations, to locate the dust collector and vacuum producer at one end of the building. Therefore the system is laid out as in Figs. 5 and 8, and the piping is sized so that the use of only one inlet, even for picking up a heavy spill, will not plug the lines (See Table 3 and Table 4).

In order to select the vacuum producer, it is necessary to calculate the highest suction required, and the rated volume at that suction. The highest suction will be needed when the four inlet valves at the end of Sub-main 1, Fig. 5 are in use. Computations are as follows:

			Inches Hg.
1. Branch 1 to point *A*. Assume at this most remote branch the minimum satisfactory volume, 70 cfm			
a. Inlet loss at tool			0.50
b. 50 Ft of 1½ in. hose @ 70 cfm			
1½ in. pipe @ 70 cfm	= 1.1 psi per 100 ft		
	= 2.24 in. Hg per 100 ft		
2.24 x 2.5(50/100)	= 2.8 in. Hg		2.80
c. Length of 2 in. pipe	= 15 ft		
1 — 90 deg elbow	= 5 ft		
1 — 45 deg elbow (entry)	= 3 ft		
	23 ft		
2 in. pipe @ 70 cfm	= 0.30 psi per 100 ft		
	= 0.61 in. Hg per 100 ft		
0.61 (23/100)	= 0.14 in. Hg		0.14
	Total 1 to point *A*	=	3.44
2. Sub-main *A* to *B*	carry over		3.44
a. 2 in. pipe @ 70 cfm	= 0.61 in. Hg per 100 ft		
0.61(75/100)	= 0.46 in. Hg		0.46
	Total to point *B*	=	3.90
3. Branch 2 to point *B* as in Item 1 above, 3.44 in. Hg @ 70 cfm			
$V^2_a = (70)^2 (3.90/3.44)$			
V_a = 74 cfm @ 3.90 in. Hg			
4. Sub-main B to C 144 cfm carry over			3.90
2½ in. pipe @ 144 cfm	= 0.54 psi per 100 ft		
	= 1.10 in. Hg per 100 ft		
1.10 (75/100)	= 0.82 in. Hg		0.82
	Total to point C	=	4.72
5. Branch 3 to point *C* as in Item 1 above, 3.44 in. Hg @ 70 cfm			
$V^2_a = (70)^2 (4.72/3.44)$			
V_a = 82 cfm @ 4.72 in Hg			
6. Sub-main *C* to *D* 226 cfm carry over			4.72
3 in. pipe @ 226 cfm	= 0.42 psi per 100 ft		
	= 0.86 in. Hg per 100 ft		
0.86 (75/100)	= 0.64 in. Hg		0.64
	Total to point D	=	5.36
7. Branch 4 to point *D* as in Item 1 above, 3.44 in. Hg @ 70 cfm			
$V^2_a = (70)^2 (5.36/3.44)$			
V_a = 88 cfm @ 5.36 in. Hg			
8. Sub-main *D* to G 314 cfm carry over			5.36
3 in. pipe @ 314 cfm	= 0.80 psi per 100 ft		
	= 1.63 in. Hg per 100 ft		
length of straight pipe	= 285 ft		
1 — 90 deg elbow	8 ft		
1 — 45 deg elbow	4 ft		
	297 ft		
1.63(297/100)	4.85		4.85
	Total to *G*	=	10.21
	Separator		0.50
	Remainder of piping negligible		0.00
	Total		10.71
Maximum suction required	= 10.71 in. Hg.		
Total exhaust volume	= 10 × 80 × 30/(30 − 10.7)		
	= 1240 cfm @ 10.7 in. Hg.		

Selection and Arrangement of Vacuum Producer

The characteristic pressure-volume performance curve of a desirable vacuum producer for vacuum cleaning service is flat — in other words, the pressure varies only slightly with the volume. With such a characteristic, it is easier to maintain the desired suction at the cleaning tool regardless of the number of outlets open, assuming that such number does not greatly exceed the number for which the system was designed. A typical characteristic curve of a high-quality vacuum producer is shown in Fig. 9.

The vacuum producer is selected to develop the required suction as indicated by the *highest* of the pressure drops in the mains (see Estimating Pressure Drop) and for the maximum volume indicated by the desired number of inlets in operation at any one time. The ratings of vacuum producers are based on the volume of air handled *at the pressure of the inlet to the compressor, not on the volume of air at standard conditions.* Thus the volume specification is calculated as follows:

$$Q = Nq\ [30/(30-p)]$$

where

- Q = design volume of the vacuum producer, cfm
- N = number of inlets in use at one time
- q = nominal volume of each inlet, cfm
- p = largest calculated pressure drop, in. Hg.

Piping connections from the dust collector to the vacuum producer, and from the vacuum producer to the outside, are usually made quite large, so that velocities will range from 2000 to 4000 fpm under maximum flow conditions. This is done in order to eliminate unnecessary friction and pressure drop where it is no longer necessary to provide conveying velocities.

The inlet pipe to the vacuum producer should be provided with a blast gate which can be closed during start-up to reduce the load on the motor as it comes up to speed. If the system is likely to be operated frequently at minimum load, a check valve may be installed in the discharge line to prevent surging of the vacuum producer.

Table 6—Miscellaneous Friction Losses[a]

Pipe fittings

Fitting[b]	Equivalent length in pipe diameters
45 deg elbows	15
90 deg elbows	32
90 deg long-sweep elbows	20
90 deg square elbows	60

Hose — 2½ times friction in same nominal pipe diameter

Primary Separators and Dust Collectors — ½ in. to 1 in. Hg

Entry Loss, Average Tool While in Use — ½ in. Hg

[a]By permission from *Chemical Engineers Handbook*, by J. H. Perry. Copyright 1950. McGraw-Hill Book Co., Inc.

[b]Use same values for equivalent Y-branches.

Selection of Dust Collector

Dust collectors used on vacuum cleaning systems are usually of the cloth arrestor type since there is normally a goodly percentage of fines associated with the material to be handled. Furthermore, the vacuum producers should be protected from unnecessary erosion. The housings for such collectors are usually cylindrical in shape in order to permit more economical design to withstand the suction pressure, frequently as high as 8 or 10 in. Hg.

Cloth area requirements for conventional types of dust collectors on this duty are usually based on velocities of 2 to 5 cfm/sq ft and pressure drops of 1-in. Hg are obtained when heavy accumulations of dust are permitted on the filter bags. On the basis that the vacuum cleaning system is used intermittently and there is plenty of available shut-down-time for bag shaking, systems are usually designed with no provision for automatic shaking. However, the provision of a continuous automatically self-cleaning collector may be a wise choice in many cases, because the task of shaking the bags of the vacuum cleaning system is one that is all too easily overlooked by busy workmen.

The material discharge valve and air seal at the bottom of the collector are minor design features of major importance. It is necessary to prevent air leakage at this point, because any appreciable leak at this point results in a high-velocity jet of air due to the high suction in the collector. This high-velocity jet entrains the collected dust in the hopper, and deposits it on the bags, resulting in unnecessarily high bag loadings, high pressure drop, and even in some cases bag erosion. The common slide-gate valve, especially if constructed of sheet metal, will soon be leaking due to the normal abuse it receives in attempts to open and shut it with the ways clogged with material. Even the ordinary rotary or *star* valve will leak after some use if the material handled is abrasive. Especially-designed rotary valves, spherical-segment valves, or soft-rubber-gasketed flapper type dump valves are more likely to be satisfactory.

Dust collectors should be preceded by cyclone primary separators if the dust is likely to be excessively light and bulky (for example, graphite chips) in order to provide the dual function of adding adequate storage space for collected material and lightening the load on the filter cloth. In some applications, fire or explosion hazards dictate the use of wet scrubber types of dust collectors.

High Pressure Pneumatic Conveying

Although the typical conveying system is quite similar to a vacuum cleaning system in many respects, and the same general design data apply to both, the few *differences in application are very important* and should be thoroughly understood by the designer. The major difference is in the amount of solids conveyed. The pneumatic conveying system frequently handles as great or a greater weight of solid materials than of air; and most of the special design considerations arise from this fact.

Since the amount of solids is so great, maintenance of conveying velocities at all times is essential; even a momentary interruption of flow or decrease in velocity is likely to result in a plugged system. Thus, for example, it is very unwise to install inlets for vacuum cleaning service on a conveying line because inadvertent use of such an outlet while the system is being used for conveying will provide the correct conditions for a plugged line.

The greatly increased amounts of solids handled result in higher pressure drops, increased erosion, more difficult dust collector problems, etc., all of which call for slightly different

treatment than in the case of the vacuum cleaning system.

Pull-Through or Push-Through Systems

Pneumatic conveying systems can be built to operate either on the intake or discharge side of the vacuum producer or compressor. Suction (pull-through) operation has the advantage that material is easily loaded into the system, manually or mechanically, in a dust-free manner. One disadvantage to the suction system is that the vacuum producer must be protected by a high-quality dust collector; but in these days of increasing attention to air pollution, such a dust collector is likely to be needed on the discharge of a push-through system anyway. The pressure (push-through) system has the advantage that a rather simple valving system permits the arrangement of multiple collection points or discharge points, whereas multiple collection points on a suction system require more complicated valving and more piping. Rotary valves, choke feed screws, etc., may be used for feeding material into a pressure system.

Estimating Load

An absolutely essential part of the design data is a trustworthy estimate of the rate at which it is necessary or desirable to handle the solid material. Furthermore, a detailed knowledge of the loading cycle is necessary, not just an overall average pounds-per-hour figure. The conveying system must not only handle the average load but the peak load. A system could be visualized where the average loading was 100 lb per min, but this 100 lb could be dumped all at once, one time per minute, into a hopper above the pick-up point of the pneumatic system. The load to the system would thus be 100 lb in a few seconds, followed by a considerable period with no load. The system must be capable of handling such surge loads, or else the surge must be smoothed out so that a smaller and more economical system can handle it. One method of smoothing out such surge loads is to provide the loading hopper with an adjustable valve to regulate the flow to the pick-up point; or if the material does not flow readily, a short section of screw-feeder may be used.

Conveying Velocity

In a conveying system, velocities must be held above the minimum necessary for conveying at all times. Such conveying velocities may be taken from the *maximum* columns of Table 3. These maximums are frequently exceeded, sometimes by as much as 50 percent, for especially heavy or hard-to convey materials. Required velocities are best determined by experiment; none of the available formulas for calculating such velocities, whether theoretical or empirical, have proven widely applicable.

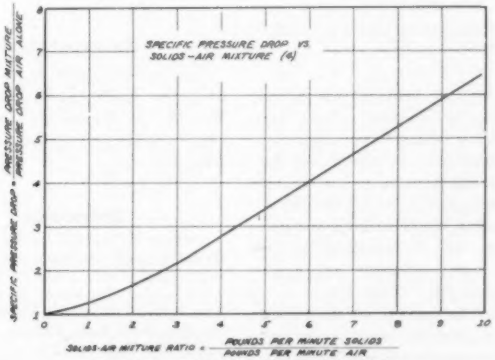

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Fig. 10—Specific pressure drop *vs.* solids-air mixture

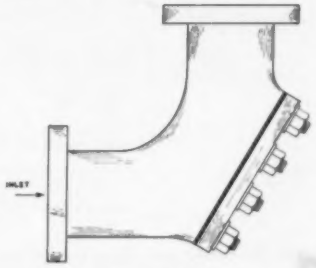

Fig. 11—Wear resisting elbow

Variation of Power With Load

It obviously requires more power to transport appreciable quantities of material from one point to another than it does to transfer merely the air without the material load. This increased power requirement appears as an increased pressure drop or resistance to flow through the pipe and fittings.

The design procedure is to select the conveying pipe size on the basis that velocities will always be above the minimum required; calculate the pressure drop on the basis of air flow alone; and correct the pressure drop according to the material load as in Fig. 10 (density of air is 0.075 lb per cu ft under normal room conditions).

Erosion Problems

Erosion problems are somewhat like corrosion problems in that detailed knowledge of the materials and circumstances in question is frequently necessary for a good solution, and that generalized statements are apt to be misleading under any given set of conditions. Erosion difficulties are

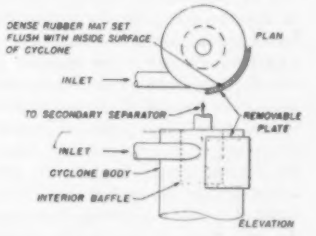

Fig. 12—Erosion plate for cyclone separator

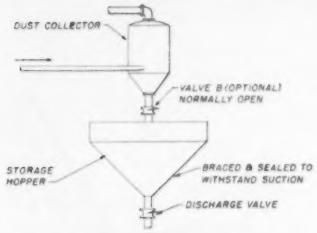

Fig. 13—Collector discharge arrangement

most likely to arise wherever the flow suffers a sharp change in direction, and thus elbows and the area facing the entry of cyclone collectors or traps are the usual points of maximum erosion. The use of unusually long-radius elbows is successful only if the problem was minimal in the first place. One type of elbow, constructed of abrasion-resisting alloys and provided with a quickly replaceable *wear section*, is shown in Fig. 11. Fig. 12 shows one design which has been successful in reducing erosion of the cyclone primary separator.

Bin Sealing

Even a small pneumatic conveying system will handle an appreciable tonnage of material in the course of a day, and in many cases it is necessary to provide storage for material at the collection point. The air and material seal at the bottom of the collector hopper is even more important here than on a vacuum sweeping system, especially if the system is of the suction (pull-through) type. The greater quantities of material handled impose more severe duty on the valve and abrasive wear will take place more quickly. The quantities of material handled usually require continuous discharge from the collector hopper through a high-quality rotary valve; and if the material is abrasive, the wear of the valve will soon allow leakage of air to a detrimental extent. One preferred method of design is to construct and brace the storage hopper beneath the collector hopper so that it will withstand the system vacuum, providing the seal valve at the bottom of the storage hopper instead of at the bottom of the collector. With this arrangement, the collector discharges continuously through an open pipe into the large storage hopper. As shown in Fig. 13, a second valve can sometimes be provided, if the collector hopper is large enough, to

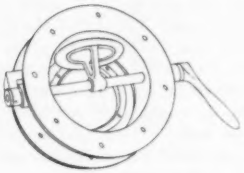

Fig. 14—Typical spherical segment valve

allow the conveying system to continue to operate while the storage hopper is being unloaded. Valve *B* may be closed for a short period of time while the hopper is being unloaded. Spherical-segment valves are usually best for this service (Fig. 14) although they have the disadvantage that they are hard to open against

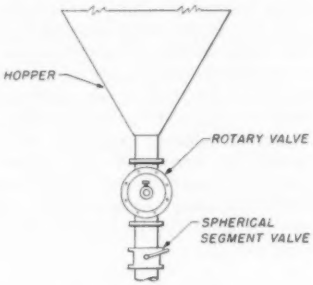

Fig. 15—Valve arrangement for abrasive packing material

a heavy load of material which has a tendency to pack or cake. One problem of handling heavy, abrasive, packing material was solved only by placing a rotary valve and a spherical-segment valve in series, the rotary valve located above to hold the material load off the spherical valve, while the spherical valve provides the tight air seal. (Fig. 15).

In order to provide uninterrupted conveying service, dust collectors should be constructed with compartments so that they may be cleaned by sections without shutting down

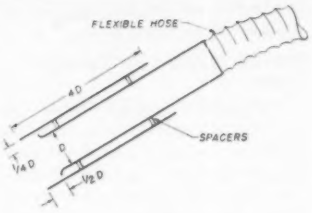

Fig. 16—Typical gulper tool

the system, or should be of a continuous automatically self-cleaning type.

Manual Loading Tools

Many applications of pneumatic conveying utilize the fact that (with a pull-through system) the material to be loaded into the conveyor can be picked up directly at the point of loading by a man using a *gulper* tool. Gulper tools are usually custom-made, in a variety of sizes and shapes to best fit the job at hand, but should always incorporate one basic principle. The tool should be designed (as illustrated in Fig. 16) so that it is not possible to completely block the flow of air by thrusting the end of the gulper completely under the surface of the material to be conveyed. If such provision is not made, minor mis-handling of the gulper tool will stop the air flow, no more material will be picked up, and there is a good probability that the material already in the pipe lines will form a plug.

Acknowledgment

The authors wish to express appreciation to Mr. J. R. Leverett and Mr. M. G. Mason of Mallinckrodt Chemical Works for their advice and assistance.

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Cooling of Water Below Wet-Bulb Temperature of Ambient Air By Cooling Tower

By S. Agnon*, Haifa, Israel; and Chia-Yung Young**, Cleveland

SUMMARY — This paper presents a method of cooling water below the wet-bulb temperature of ambient air by means of a cooling tower. To accomplish this, an additional heat exchanger is required, and the tower must be enlarged if the capacity is to remain constant. The enlargement factor of the tower is developed theoretically, and a sample design chart has been made to facilitate its calculation. A practical example is included to illustrate the application of the proposed method.

A COOLING tower is a heat exchanger in which water to be cooled is allowed to come into direct contact with the surrounding air. Due to the fact that atmospheric air is generally only partly saturated with water vapor, some water will evaporate into the air. Such an evaporation process produces a large cooling effect which, in a well-designed tower, might lower the water temperature as much as 20 F under some conditions.

Present-day analysis of cooling tower performances depends on the assumption that the difference in enthalpies between the atmospheric air and water is the driving force for the energy exchange process in the tower. Since the enthalpy of atmospheric air is very nearly determined by its wet-bulb temperature only, it follows that the degree of cooling obtainable is dependent only on the inlet air wet-bulb temperature.[1] Hence, it has been concluded that a cooling tower fails to be of any use if it is desired to cool water below the wet-bulb temperature of the ambient air. This paper proposes an arrangement of heat exchangers, with the cooling tower as the primary one, which overcomes this difficulty.

Such an arrangement would not only increase the efficiency of the cooling tower, but at the same time would also stimulate wider application of cooling towers whose usefulness in some cases has hitherto been limited for climatic reasons.

Description of Arrangement

For a cooling tower to perform properly, it is necessary that the leaving water temperature must be a few degrees above the entering air wet-bulb temperature. This difference has been defined as the *approach of the cooling tower*.[2] The *approach* is an important factor to be considered in the design and selection of a cooling tower because it affects the performance of the tower. In general the *approach* might be taken as at least 5 F.

Should the wet-bulb temperature of ambient air be higher than the desired water temperature, it would then seem necessary only to lower the wet-bulb temperature. This can be done as shown in Fig. 1, by passing the air through a heat exchanger or air-cooler before it is introduced into the tower. The air cooler is simply a sensible heat exchanger, such as a cooling coil with extended surface. The coolant used in the air cooler is part of the chilled water from the tower.

A second suggestion is to pass the entire water flow through the air cooler. However, such an arrangement necessitates a lower water temperature leaving the tower. That in effect decreases the *approach*, and hence the efficiency, of the tower. For this reason, this arrangement will not be discussed in this paper.

The process of air-cooling in the air cooler and air humidifying in the cooling tower may be represented as curve 3-1-2 on a psychrometric chart shown in Fig. 2.

The amount of air-cooling required, and hence the size of the air cooler, is determined by the wet-bulb temperature, t_{wb1}, at 1, which must be of such magnitude that it will fulfill the *approach* requirement of the tower.

Alternate Arrangement: The dry-bulb temperature of air leaving the tower, t_2, is sometimes considerably lower than that of the ambient air. This fact points to a possibility of further improving the heat transfer process in cooling the air. To achieve this, another sensible heat exchanger, referred to as a regenerator, is added to the air circuit. This arrangement will enable the regenerator to precool the air before it is drawn through the air cooler. The regenerator can be any type of gas heater, such as the tubular air heater used in many steam power plants.

As shown in Fig. 3, the air leaving the cooling tower is now being utilized to cool the ambient air to an intermediate temperature t_{2a}. Further cooling of air to t_3 is achieved by the air cooler. Curve 3-3a-1-2-4 in Fig. 4 shows the complete psychrometric process of the air.

It must be stressed here that the installation of a regenerator is not often justified economically, unless the ambient air temperature is considerably higher than that of the air leaving the tower.

To summarize the foregoing discussion, it can be said that the proposed arrangement is essentially

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[1]Exponent numerals refer to References.

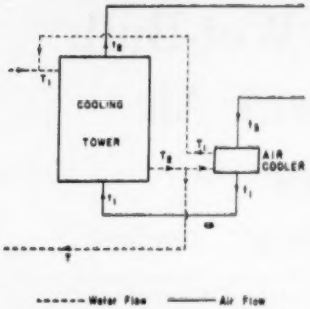

Fig. 1—Proposed arrangement of cooling tower with air cooler

composed of two stages, with a third one as optional.

1. *Cooling of Air:* During this stage a sensible heat exchanger is used to cool the air so that its wet-bulb temperature will be below the water temperature by the amount determined by the *approach* of the cooling tower.

2. *Cooling of water:* With air available at a lower wet-bulb temperature, the cooling tower can now function satisfactorily and yield chilled water at the desired temperature level.

3. *Precooling of air:* This is an optional stage during which air leaving the tower is utilized to precool the surrounding air. This heat transfer process is carried out in the so-called *regenerator.*

Consideration will first be given to the arrangement without the regenerator. Assuming that the loss due to evaporation is negligible in the tower, the mass water flow will remain essentially constant. If adiabatic conditions may be postulated in the tower and throughout the entire process, the load on the tower is

$$Q_e = W_e \Delta T \qquad (1)$$

To remove this heat load, the amount of air needed at condition 1 (see Fig. 1) can be determined by the following considerations:

In the cooling tower an energy balance between air and water yields the expression:

$$W_e dT = M_e dh_a$$

where

M_e = the air mass flow corresponding to the water mass flow W_e, pounds of dry air per hour.

d = a differential sign.

With constant mass flows, W_e and M_e, in the tower,

$$\frac{dh_a}{dT} = \frac{W_e}{M_e} = a\ constant,\ say,\ \tan\phi$$

Therefore in an enthalpy-temperature diagram (see Fig. 2),[2] which relates the instantaneous conditions of air and water in the cooling tower, the cooling process appears to be a straight line. This straight line is often referred to as the *operating line,* and its slope is evidently $dh_a/dT = \tan\phi$

Thus, it can be concluded that

$$M_e = \frac{W_e}{\tan\phi} \qquad (2)$$

tan ϕ is a design characteristic of the tower. It can be obtained from manufacturers' catalogues or by following any of the methods for cooling tower analysis now in use.

Nomenclature

W = total amount of water circulating in the cooling tower, pounds per hour.

W_e = amount of recirculating water determined by the process for which water is being used as the coolant, pounds per hour.

M = total amount of air flow through the tower, pounds of dry air per hour.

ΔT = desired temperature drop in water to be achieved in the tower, Fahrenheit degrees.

T = water temperature at any point with the subscript specifying its exact location, Fahrenheit.

t = dry-bulb temperature of air at any point with the subscript specifying its exact location, Fahrenheit.

t_{wb} = wet-bulb temperature of air at any point with the subscript specifying its exact location, Fahrenheit.

h_a = enthalpy of atmospheric air at any point in the tower, Btu per pound of dry air.

c_w = specific heat of water, Btu per (pound) (Fahrenheit degree).

c_p = specific heat of humid air, Btu per (pound of dry air) Fahrenheit degree).

Q_e = heat load of the process for which water is being used as the coolant, Btu per hour.

Subscripts: 1 and 2 refer to incoming and outgoing conditions, e and f refer to the process and air cooler, respectively.

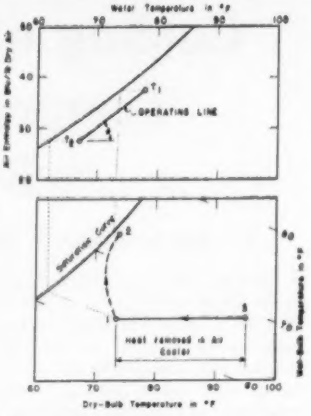

Fig. 2—Psychrometric process of air in the proposed arrangement

In order to provide for the additional cooling water for the air cooler, the water flow must be increased and the tower size correspondingly increased.

From a heat balance consideration in the air cooler,

$$Mc_p(t_2 - t_1) = W_f c_w (T_f - T_1) \qquad (3)$$

where W_f is the water flow in the air cooler while M is the total air flow.

Therefore in the enlarged tower the actual air and water flows are M and W ($W = W_e + W_f$) respectively. These two flow quantities can be related by the same expression shown in Equation 2. Thus,

$$M = \frac{W_e + W_f}{\tan\phi} \qquad (4)$$

Eliminating M from Equation 4 by the substitution of Equation 3 since c_w is unity,

$$\frac{W_f(T_f - T_1)}{(t_2 - t_1)c_p} = \frac{W_e + W_f}{\tan\phi} = \frac{W}{\tan\phi}$$

By rearranging,

$$\frac{W_f}{W} = \frac{(t_2 - t_1)c_p}{(T_f - T_1)\tan\phi}$$

$$1 - \frac{W_e}{W} = \frac{(t_2 - t_1)c_p}{\Delta T \cdot \tan\phi}$$

$$\frac{W_e}{W} = 1 - \frac{(t_2 - t_1)c_p}{\Delta T \cdot \tan\phi}$$

$$m = \frac{W}{W_e} = \frac{1}{1 - \frac{(t_2 - t_1)c_p}{\Delta T \cdot \tan\phi}} \qquad (5)$$

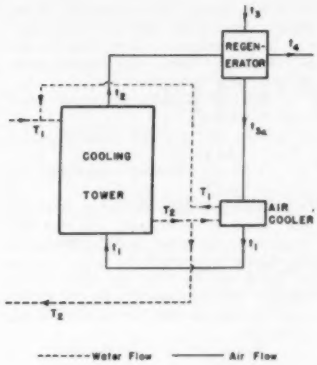

Fig. 3—Proposed arrangement of cooling tower with air cooler and regenerator

In Equation 5, m is the parameter representing the factor that the designed tower must be enlarged in order to provide for additional water flow for the cooling of ambient air. Obviously m must always be larger than 1.

Now consider the complete arrangement with the regenerator. By referring to Fig. 4, it can be seen that the sensible heat removed in each of the two units, the air cooler and the regenerator, can be expressed as:

$$q_c = Mc_p(t_{3a} - t_1)$$
$$q_r = Mc_p(t_3 - t_{2a}) \quad \text{----------(6)}$$

where

q_c = heat removed in the air cooler.
q_r = heat removed in the regenerator.

Let r be the ratio of the sensible heat removed in the air cooler to the total removed in both units. Then,

$$r = \frac{t_{3a} - t_1}{t_3 - t_1} \quad \text{----------(7)}$$

When there is no regenerating stage t_3 is the same as t_{3a}, and r is obviously equal to 1.

With the addition of the regenerator, Equation 5 should be modified to appear as:

$$m = \frac{1}{1 - \frac{r(t_3 - t_1)c_p}{\Delta T \tan \phi}} \quad \text{----------(8)}$$

Let,

$$p = \frac{(t_3 - t_1)c_p}{\Delta T}$$

The newly defined parameter p embodies all temperature terms. Obviously the higher the value p is; the higher is the ambient air temperature, other conditions being the same; and the more unfavorable it is for the operation of the cooling tower. Equation 8 can now be simplified to:

$$m = \frac{1}{1 - \frac{pr}{\tan \phi}} \quad \text{----------(9)}$$

The design of the air cooler and the regenerator is beyond the scope of this paper. The readers are referred to any heat transfer text where complete discussion on such equipment has been covered.

Design Charts

Design charts based on Equation 9 have been developed and drawn with parameters m as ordinates and p as abscissas. Other parameters of the charts are tan ϕ and r. The humid specific heat c_p can be taken as constant at 0.245 without introducing great error. A typical example of a design chart, such as Fig. 5, shows a family of curves with constant tan ϕ and with r as the third parameter, varying from 0.1 to 1.0. The value of tan ϕ will in a majority of cases vary between 0.6 and 1.4, and is arbitrarily selected as 0.8 in the example of Fig. 5. Similar curves based on tan ϕ other than 0.8, may be constructed whenever the need for the chart arises in order to facilitate calculations.

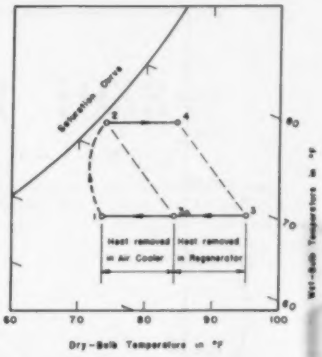

Fig. 4—Psychrometric process of air in the proposed arrangement with regenerator

Practical Consideration

The enlargement factor m found from Equation 9 or from the design charts is the factor by which the amount of cooling water W_c must be multiplied in order to obtain the amount of total cooling water recirculating in the cooling tower. The size of the tower must therefore be selected on the basis of the latter figure, W.

It should be pointed out that any standardized type of cooling tower can be adapted for use in this proposed process. The only additional items of equipment required are the air cooler and the regenerator.

From the inspection of design charts, Fig. 5, it is evident that for higher values of the parameter p (*i.e.*, for higher ambient air tem-

Table 1—Tabulation of Calculations for Designs without and with Regenerator

	Design without Regenerator, $r = 0$	Design with Regenerator $r = 0.5$
I tan ϕ, (assumed to be)	0.8	0.8
II p = [(95 — 73.6) 0.245]/[78 — 67] [ambient air temperature is taken as 95 F DB]	0.477	0.477
III Enlargement factor, m [Fig. 5 or Equation 9]	2.50	1.43
IV Water flow in the tower, gpm [= 22 × m]	55.4	30.8
V Air flow in the tower, cfm [= (11000/60) × (1/0.8) × m × (1/0.075)] [air density taken as 0.075 lb/cu ft]	7700	4250
VI Design Load for the Air Cooler, Btu/hr [(11000/0.8) × 0.245 × (95 — 73.6) × m]	180,000	
[(11000/0.8) × 0.245 × (95 — 73.6) × m × r]		51,000
VII Design Load for the Regenerator, Btu/hr	—	51,000

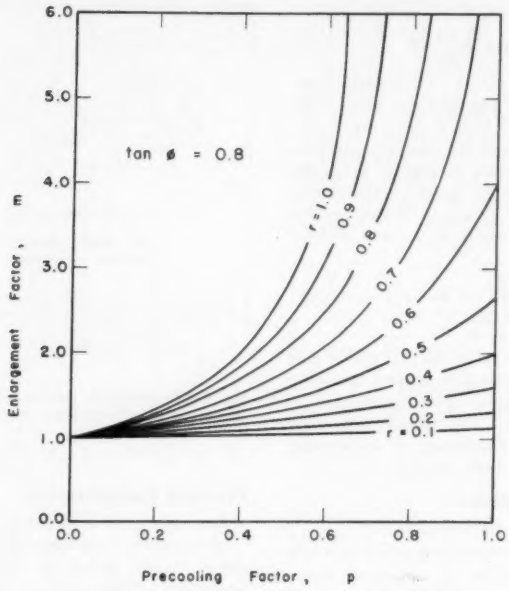

Fig. 5—Design chart for the enlargement factor m

peratures) the adoption of the regenerator is quite necessary in order to avoid an excessively large cooling tower. For smaller values the regenerator might be omitted. In this case the saving of the cost of the regenerator will be offset somewhat by the additional cost for a larger tower and air cooler and the additional power cost for handling larger quantities of air and water. In any event, several designs should be made in order to reach a most economical one.

Example of Application

To illustrate the practical application of the proposed process presented in this paper, the following example will be considered.

Example: A certain chemical process requires cooling water having inlet and outlet temperatures at 68 F and 78 F respectively. The heat load of the process is 110,000 Btu per hr. In addition the piping system will pick up a certain amount of heat estimated at approximately 10 percent of the total load.

Weather records have shown that the dew point of the air remains nearly constant at 55 F during the summer months. For many hours during the day air temperatures may reach values between 90 and 95 F (dry-bulb) and 69 F wet-bulb. It is evident that by using a standard cooling tower the required water temperature for cooling the chemical process cannot be attained because of the 69 F wet-bulb temperature.

Required: By using the modified cooling process described in this paper, determine the size of the enlarged tower and the sizes of additional equipment, if used.

Solution: A few preliminary calculations will be made first. Then two alternative designs, one without regenerator and the other with regenerator will be tabulated for comparison in Table 1.

1. *Determination of amount of recirculating water as coolant:*

The cooling load required by the chemical process is 110,000 Btu per hr.

Temperature drop of ΔT of water when used as coolant = 10 F.

Amount of recirculating water = 11,000 lb per hr = 11,000 x 1/8.35 = 1320 gph = 22 gpm.

2. *Determination of operational temperatures of air and water across the cooling tower:*

Assuming that there will be a 1 F deg temperature rise in water as it flows from the cooling tower to the chemical process to account for the 10 percent heat load picked up in the piping, then

Inlet water temperature, T_1 = 78 F

Outlet water temperature, T_2 = 67 F

In order to cool the water to 67 F, the wet-bulb temperature of the inlet air will be a few degrees lower than T_2 by an amount equal to the *approach* of the tower. In this example assume that the *approach* is 5 F. Hence the inlet condition of air is now being fixed at:

Inlet air wet-bulb temperature, t_{wb1} = 62.0 F

Inlet air dry-bulb temperature, t_1 = 73.6 F

Inlet air dew-point temperature t_{dp1} = 55.2 F

Air emerging from the tower is invariably close to saturation. Its wet-bulb temperature can either be determined from the energy balance in the tower, or can be found directly from the enthalpy-temperature diagram shown in Fig. 2. In this case the leaving condition of air is being taken as:

Outlet air dry-bulb temperature, t_2 = 74 F

Outlet air wet-bulb temperature, t_{wb2} = 73 F

All the pertinent data have now been ascertained so that the equipment may be sized. The design with the regenerator will be made on the basis that the regenerator and the air cooler will each share equally the sensible heat load of cooling the ambient air. In other words, the parameter r will be assumed to be 0.5. The solutions for both designs are shown in Table 1.

The tabulated results indicate that the design with regenerator should be preferred. Otherwise, the size of the cooling tower would almost be doubled, and that of the air cooler would be approximately fourfold. Furthermore, about twice as much water and air would have to be handled through the tower and the air cooler.

It should be noted finally that in the range considered each degree of air pre-cooling (by either means) produces very roughly an additional 0.3 F deg lowering of water temperature.

Acknowledgment

The authors wish to express their indebtedness to Prof. L. G. Seigel at Case Institute of Technology for his suggestions after reading the test. They also wish to thank Miss Joyne Knox for preparing the final form of the manuscript.

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2. A Temperature — Total Heat Diagram for Cooling Tower Calculations, by B. Wood and P. Bitts (*The Engineer*, March 17, 1950, p. 337).

NOMINATIONS FOR 1953

Officers and Council

The Nominating Committee, selected in accordance with the provisions of **Article VIII** — *Section 3* of the By-Laws, has submitted the following nominees for Officers and members of Council for 1953:

President
REG F. TAYLOR, Houston, Tex.
First Vice President
LOUIS N. HUNTER, Johnstown, Pa.
Second Vice President
JOHN E. HAINES, Minneapolis, Minn.
Treasurer
JOHN W. JAMES, Chicago, Ill.

Members of Council *(Three-Year Term)*
IRWIN W. COTTON, Indianapolis, Ind.
ARTHUR W. EDWARDS, Cincinnati, Ohio
BRUCE L. EVANS, St. Louis, Mo.
LEON T. MART, Kansas City, Mo.
E. R. QUEER, State College, Pa.

Respectfully submitted,
NOMINATING COMMITTEE
M. W. Bishop, *Chairman*
D. M. Allen, *Vice Chairman*
C. B. Gamble, *Secretary*

A. B. Algren	A. J. Hess
B. W. Farnes	W. G. Hole
E. L. Crosby	B. M. Kluge
W. A. Grant	A. J. Offner

G. T. Donceel, *Alternate*

In accordance with the provisions of the Society's By-Laws, ballots containing the names of the above candidates will be sent to the membership prior to the Annual Meeting in January.

Article VIII

Section 4. Other Nominations. Nominations of officers and members of the Council, other than those nominated by the Nominating Committee, and nominations of members of the Committee on Research, other than those nominated by the Council, may be made in writing by at least fifty (50) members eligible to vote, upon presentation of such nominations, with each nominee's consent, to the Executive Secretary at least sixty (60) days prior to the opening of the first session of the Annual Meeting, whereupon the nominees' names shall be placed upon the ballot with a notation that they are presented by members independent of the Nominating Committee.

Section 5. Voting. Voting at any meeting may be in person or by proxy, but only the Executive Secretary and MEMBERS of the Society shall be eligible to act as proxies. Proxies shall not be valid for more than three (3) months from dates of execution. The Executive Secretary and the MEMBERS acting as proxies shall hold the ballots of their principals secret and confidential. Voting for election of officers, Council members, members of the Committee on Research, on proposals to amend these By-Laws, and on questions required to be referred to the Society pursuant to *Article V, Section 2*, shall be by secret ballot. In the event of any tie vote, the Council shall decide the vote.

Section 6. Ballots. Together with notice of the Annual Meeting, the Executive Secretary shall forward appropriate proxies and ballots to members entitled to vote. The proxies and ballots shall contain spaces for write-in names.

Members of Committee on Research

The election of the Committee on Research is governed by the By-Laws for the election of Officers, with the exception that members of the Committee on Research are nominated by the Council.

In accordance with the provisions of **Article VII** — *Section 3 (h)* the Council announces the nomination of the following members of the Committee for election to succeed those members whose present terms expire January 1953.

Committee on Research *(Three-Year Term)*

RICHARD S. DILL, Washington, D.C.
FRANK H. FAUST, Bloomfield, N.J.
ROBERT W. KEETON, M.D., Chicago, Ill.
HAROLD A. LOCKHART, Morton Grove, Ill.
JOHN W. MCELGIN, Philadelphia, Pa.
One-Year Term
ARTHUR J. HESS, Los Angeles, Calif.

Article VII

Section 3. General Committees. (*h*) *Committee on Research*, consisting of fifteen (15) MEMBERS, nominated by the Council or as provided in *Article VIII, Section 4*, and elected by the Society in the manner of elected officers. . . . . .

NOMINEES FOR OFFICERS — 1953

For President — *Reg F. Taylor,* consulting engineer, Houston, was born in Toronto, Ont., and educated in public and preparatory schools in England and Pietermaritzburg, Natal, South Africa, where he served an engineering apprenticeship with an architectural-engineering firm.

Reg F. Taylor
Houston, Tex.

Mr. Taylor entered the United States from Canada in 1908 and for a time was engaged in the design of heating and ventilating projects in the Texas territory. He later was associated with architectural firms in Texas and Kansas City as a mechanical-electrical engineer, and was engaged in this work until the outbreak of World War I, when he served as a member of the 110th Engineers, 35th Division (Kansas-Missouri), with one year's overseas duty.

Upon his discharge from the Army, Mr. Taylor entered private practice as a consulting engineer in Dallas, maintaining this office until 1938, when he transferred it to Houston, and began practice there.

He has specialized in heating, ventilating, air conditioning, and electrical design for various types of buildings, including federal housing projects, hospitals, schools, theaters, and industrial plants, principally in Texas, Louisiana, Oklahoma, Arkansas, Alabama, Arizona, and Missouri.

Mr. Taylor joined the Society in 1915 and is one of the Charter members of the Kansas City Chapter. He was located in Dallas when the Texas Chapter was first organized in 1937 and served as its president. When the Texas Chapter was divided into the North Texas and South Texas Chapters, he served as president of the South Texas Chapter in 1939. He also served as a member of its Board of Governors in 1940, 1943, and 1944, and on numerous Chapter committees.

Mr. Taylor was elected a member of the Society's Council for a three-year term, 1947-49, treasurer, 1950, second vice president, 1951, and currently is serving as first vice president of the Society. Among Society positions in which he has served are: chairman, Special Committee on Chapter Relations, 1947; chairman, Membership Committee, 1948; chairman, Program and Papers Committee, 1949; ex-officio, Executive Committee, 1950; ex-officio, Finance Committee, 1950; member, Executive Committee, 1951; chairman, Finance Committee, 1951; and Ways and Means Committee, 1951. Mr. Taylor is a registered professional engineer in the State of Texas and a member of the *Texas Society of Professional Engineers*, the *American Institute of Electrical Engineers*, the Rotary Club of Houston, Houston Engineers Club, and Houston Electric Club.

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For First Vice President — *L. N. Hunter,* vice president of research, The National Radiator Co., Johnstown, Pa., was born August 27, 1903, in Brampton, Ont., where he received his preliminary education and attended the University of Toronto, receiving his degree of B.A.Sc. in 1925.

Mr. Hunter began his career with the Bryant Heater Co., Cleveland, as assistant research engineer. He served in this position for four years and then joined the staff of The National Radiator Co. as gas engineer, assigned to the design and testing of gas-fired home heating boilers and controls, and also to the design and testing of special cast-iron, gas-fired boilers for treating crude oil emulsions.

In 1932, he was made assistant manager of the firm's Research Department, where he supervised the design, test and research work on coal, oil and gas-fired boilers, oil burners, stokers, radiators, convectors and air conditioning equipment, and accessories and controls.

In 1935, Mr. Hunter was promoted to manager of the Research

L. N. Hunter
Johnstown, Pa.

Department and in 1941 was appointed vice president and manager of research. Since 1943, he has served on the Board of Directors.

Mr. Hunter joined the Society in 1935 and served on Technical Advisory Committees on Radiation and Comfort, and on the Solid Fuels Committee from 1939 to 1942. In 1948 and 1949, he served as chairman of the Society's Committee on Research; also as a member of its Executive Committee in 1946 and 1947; as chairman of its Executive Committee in 1948-49 and as a member of the Committee in 1950.

Mr. Hunter served on the TAC on Fuels, 1947; the TAC on Panel

Heating and Cooling, 1948, 1950, 1951-52; TAC on Combustion, 1950; TAC on Hot Water and Steam Heating, 1950-52; and Standards Committee, 1951-52. He was elected to Council in 1951 and is currently a member of Council and the Executive Committee of Council. He was also elected Second Vice President in 1952.

Mr. Hunter also is a member of the *American Society of Mechanical Engineers* and is serving on its Heating Boiler Code Committee; *American Chemical Society; American Gas Association; Air Pollution and Smoke Prevention Association of America; American Society for Metals; American Ordnance Association;* the Sunnehanna Country Club; and the Bachelors Club.

In addition, he has served on committees of the *Institute of Boiler and Radiator Manufacturers;* the *Steel Boiler Institute;* the *Oil Heat Institute of America;* and the *Gas Appliance Manufacturers Association.*

✦

For Second Vice President — *John E. Haines,* vice president, Minneapolis-Honeywell Regulator Co., Minneapolis, has spent almost his entire career with the company

J. E. Haines
Minneapolis, Minn.

in various capacities. Mr. Haines has served the Modutrol Division as manager of the New York office and assistant manager of its Minneapolis division; manager of the National Regulator Division, Chicago; in 1940 was made manager of the Commercial Controls Division, and a vice president in 1945. He is presently in charge of the Commercial Controls Division in Minneapolis and the Appliance Controls Division in Los Angeles.

Born in Noblesville, Ind., on November 8, 1903, Mr. Haines attended Purdue University, graduating in 1925 with a B.S. in chemical engineering.

Mr. Haines joined the Society in 1940 and has served as president and vice president of the Minnesota Chapter, 1946-47 and 1945-46, respectively. In 1949 he acted as general chairman of the Committee on Arrangements for the Semi-Annual Meeting held in Minneapolis. He has also served on the following Society committees: Chapter Delegates, 1945-46; Nominating, 1945-46 and 1948, serving as chairman in 1947; Chapter Relations, chairman, 1950-51; Ways and Means, 1951; Membership, chairman, 1952; and Promotion of Research, chairman, 1947-49. Mr. Haines has been a member of Council since 1950.

He has written and lectured extensively on automatic controls and their applications and has recently completed a textbook on *Automatic Control of Heating and Air Conditioning* which will be published early in 1953. He is a member of the *American Society of Refrigerating Engineers* and the Delta Chi Fraternity.

✦

For Treasurer—*John W. James,* Chicago, vice president in charge of research for McDonnell & Miller, Inc., is also known to many members for his eight years association with ASHVE as technical secretary.

Following graduation from Oregon State College in 1928, Mr. James was associated with a consulting engineer specializing in heating and ventilating in Portland. Four years later he was awarded a research fellowship at the University of Wisconsin where he received an M.S. degree in 1934 and then entered the research field through General Electric Co. in Schenectady, N. Y. His activities have included 3 years as instructor and research adviser at the Polytechnic Institute of Brooklyn and for 5 years before joining the McDonnell & Miller organization he participated in design and development work with Iron Fireman Manufacturing Co. in Cleveland.

He is co-author of the textbook, *Heating and Air Conditioning,* by Allen, Walker and James, and was a contributor to the 12th edition of *Kent's Mechanical Engineers' Handbook;* was associate editor of the

J. W. James
Chicago, Ill.

1949 edition of the *Handbook of Oil Burning;* served as technical editor of THE GUIDE from 1936 to 1943, and is author of a long list of articles in engineering publications.

As a Society member, Mr. James is currently completing a three-year term on Council where he has served as chairman of the Finance Committee and Program and Papers Committee. He was also appointed for a term as chairman of the Publication Committee, and has served as a member of the Society's Constitution and By-Laws, Nominating, Publication Policy and Guide Publication Committees. He was elected to two terms on the Committee on Research, serving as vice chairman in 1949, and is currently chairman of the TAC on Hot Water and Steam Heating and a member of the TAC on Panel Heating and Cooling.

He is now affiliated with the Illinois Chapter of ASHVE, and was president of the Northern Ohio Chapter in 1947. He is a registered professional engineer in the States of Oregon and Ohio and also is a member of Sigma Xi, Phi Sigma Kappa, and the *American Society of Sanitary Engineers.* Mr. James is also a member of the *American Society of Mechanical Engineers* and is serving on its Heating Boiler Code Committee.

NOMINEES FOR COUNCIL — 1953

Three-Year Term

Irwin W. Cotton, president, I. W. Cotton Co., Inc., Indianapolis, was born on September 23, 1887, in Greensboro, Ind., and attended But-

I. W. Cotton
Indianapolis, Ind.

ler University. He received B.S. degrees from J. B. Stetson University and from the University of Chicago in 1908.

Following four years as a bank bookkeeper, Mr. Cotton entered the heating contracting field in Greenfield, Ind., and was engaged in this work until World War I. During the war, he was an engineering officer in the United States Naval Reserve and served on both the USS Pequot and USS Mongolia. After release from active duty, Mr. Cotton re-entered the heating contracting field in Indianapolis continuing until 1928, when he organized the I. W. Cotton Co., Inc. In 1930 the type of business was changed to the distribution of controls, and later the representation of manufacturers of air distribution, cleaning, exhausters and accessory equipment was undertaken. In 1942, Mr. Cotton took a one-year leave of absence from the company to serve as district fuel rationing officer, Indianapolis District, Office of Price Administration. In 1948 he served on the Indianapolis Anti-Air Pollution Board.

Mr. Cotton joined the Society in 1943 and has been an active member in the Indiana Chapter, serving as its vice president in 1946, as president in 1947, chapter delegate 1946-49, and as a member of its board of governors, 1945-46 and 1948-49. Currently serving as chairman of the Committee on Research, Mr. Cotton served as a member of that committee in 1949 and 1950, and as chairman in 1951.

Mr. Cotton is a member of the Indianapolis Air Conditioning Council, Indianapolis Chamber of Commerce, Construction League of Indianapolis, American Legion and the Service Club of Indianapolis, and is an elected member of the Marion County Council. He has also authored a number of papers and articles on heating, ventilation, and air conditioning. He is listed in *Who's Who in the Mid-West, Who's Who in Engineering,* and *Who's Who in America.*

✦

A. W. Edwards
Cincinnati, Ohio

Arthur W. Edwards, district manager, The Trane Co., Cincinnati, was born on February 21, 1900, at Highland, Wis. He attended the University of Wisconsin and graduated with a B.S. in mechanical engineering in 1925.

Mr. Edwards joined The Trane Co. in 1925 as a student engineer in the company's office at La Crosse. In 1926 he was transferred to Cincinnati, where he was made district manager, in which capacity he has served since.

Mr. Edwards has been a member of the Society since 1936 and is affiliated with the Cincinnati Chapter. He has served as the Chapter's president, vice president and secretary-treasurer, 1946-47, 1945-46, and 1944-45, respectively, and has also served on its board of governors in 1943-44 and 1947-48. He has served on the following Society committees: Nominating, 1946-47 and 1949; Chapter Delegates, 1947; chairman, Sub-Committee on Chapter By-Laws, 1947-49; chairman, Chapters Conference, 1949-50; Admission and Advancement, 1950-52, of which he is currently serving as chairman.

He is a member of the Masons, Scottish Rites, the Optimist Club, and the *Engineering Society of Cincinnati;* and he is a registered professional engineer in the State of Ohio.

✦

Bruce L. Evans organized the Bruce L. Evans Co., St. Louis, in 1949, after more than 20 years in the heating and air conditioning field. Mr. Evans was born on April 30, 1904, at Le Grand, Ia., and attended Washington University Extension School in St. Louis.

Mr. Evans was employed with Chevrolet Motor Co., St. Louis, from 1926-28, at which time he joined the Langenberg Mfg. Co., where he was engaged in the service and sale of heating equipment until 1931. He was associated with the P-M Steel

B. L. Evans
St. Louis, Mo.

Products Mfg. Co. between 1931-32 in the capacity of superintendent of production. In 1932 he returned to Langenberg, which was then called

the Langenberg Heating Co., where he supervised the design and installation of heating, cooling and air conditioning systems.

Mr. Evans joined the Society in 1937 and served as the St. Louis Chapter's alternate on the Nominating Committee in 1945 and 1946 and as secretary of the committee in 1951. He has served as chairman and vice chairman of the Chapters Conference Committee in 1950 and 1949, respectively, and as the St. Louis Chapter's delegate on this committee in 1946, 1949 and 1950, as the alternate in 1947 and 1948. Mr. Evans is an active member of the St. Louis Chapter, serving as its secretary, 1944, second vice president, 1946 and 1947, and president, 1948. He also served on its board of governors. Mr. Evans was general chairman of the Committee on Arrangements for the 58th Annual Meeting held in St. Louis in January 1952.

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E. R. Queer, director of the Department of Engineering Research, The Pennsylvania State College, State College, Pa., was born on May 26, 1904, in Johnstown, Pa. Professor Queer attended The Pennsylvania

E. R. Queer
State College, Pa.

State College, receiving his B.S. and M.S. degrees in 1926 and 1928, respectively. He has been associated with the College in the field of research since graduation. He was appointed director of the Department of Engineering Research on September 1. He is also a consultant to the Chief of Army Ordnance, the Bureau of Yards and Docks of the Navy and the Pittsburgh Lectrodryer Corp.

Professor Queer joined the Society in 1933 and has been an active member, serving as a member of Council since 1950. He has also served on many Society committees such as: Federal Liaison, 1949; chairman, Program and Papers, 1951 and 1952; Admission and Advancement, 1945-47, serving as chairman from 1947-48; Committee on Research, 1948-50; TAC on Navy Studies, 1948; and TAC on Air Sterilization, 1948. He is currently serving on the Finance and Ways & Means Committees.

He is also a member of the *Society of Naval Architects and Marine Engineers, United States Naval Institute, Society of Naval Engineers, American Society for Testing Materials,* Sigma Xi and Theta Xi fraternities. As a member of the U. S. Navy Reserve, he served in World War II and holds the rank of commander since March 1944. Professor Queer is a registered professional engineer in the State of Pennsylvania and has written many books and papers, some of which have been published in both the Society's JOURNAL and TRANSACTIONS.

✦

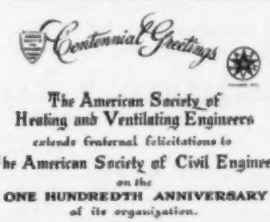
Leon T. Mart, president, The Marley Co., Inc., Kansas City, Mo., was born in Portland, Me., on June 16, 1891. Mr. Mart attended Lehigh University, graduating in 1913 with an M.E. degree.

From 1913-16 Mr. Mart was employed with various companies as superintendent in plant construction and maintenance work. He served with the United States Army in the Ordnance Department from 1917-19, with 10 months foreign service. In 1922 he joined The Marley Co., and has been general manager and president since that date. In this capacity,

L. T. Mart
Kansas City, Mo.

Mr. Mart has been engaged in engineering design, erection, sales and general administration work.

He joined the Society in 1941 and served as president and vice president of the Kansas City Chapter in 1943 and 1942, respectively, and as a member of its board of governors in 1944. Mr. Mart also served on the Society's Nominating Committee in 1947. He is a member of the Kansas City Engineer's Club, *American Society of Mechanical Engineers,* the *American Society of Refrigerating Engineers* and the Rotary Club. He also is director of the Kansas City Chamber of Commerce.


Centennial Greetings
The American Society of
Heating and Ventilating Engineers
extends fraternal felicitations to
The American Society of Civil Engineers
on the
ONE HUNDREDTH ANNIVERSARY
of its organization.
Its pioneering in the engineering profession has brought incalculable public benefits. It has played a notable part in the progress of this and other countries in peace and in war and has strengthened the foundations of the free nations.
Congratulations on such significant and far-reaching achievements.
September 1952

Illuminated scroll presented to Pres. Carlton Proctor of *ASCE,* September 8, at *ASME* International Presidents' Luncheon in Chicago by Pres. Ernest Szekely of ASHVE

OCTOBER TRIPS FOR OFFICERS

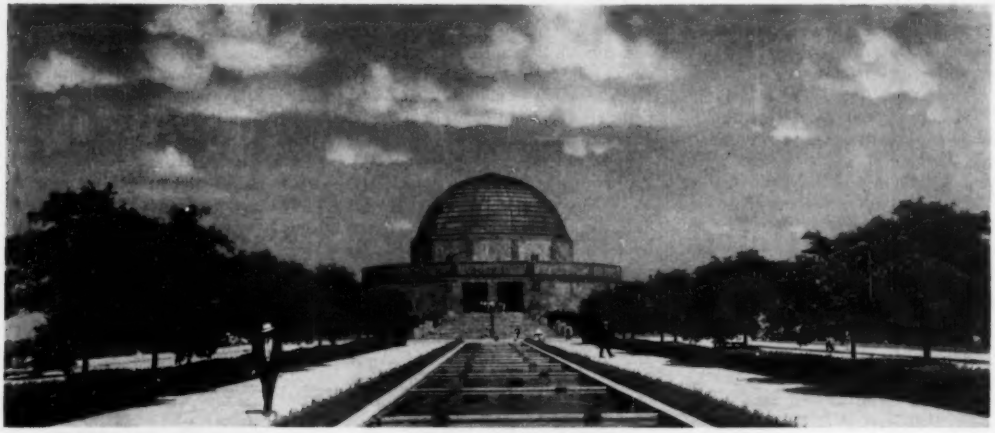
Society Officers visits to Chapters are scheduled as follows:

Pres. Ernest Szekely — Washington, D.C. October 8; Michigan 13th; New York the 20th; Massachusetts the 21st; Central New York the 22nd.

First Vice Pres. Reg F. Taylor — Kansas City October 6; Kansas the 7th; Oklahoma the 13th; Northeastern Oklahoma the 14th.

Second Vice Pres. L. N. Hunter — Ontario October 6; Montreal the 13th.

The Fall Council Meeting is scheduled for October 11, at the Hotel Statler, New York.



The Adler Planetarium

Chicago, the Center of America's Heartland

MARK THE calendar now and remember you have a date in Chicago for the week of January 26 when several thousand members of the heating and air conditioning profession assemble for the 59th Annual Meeting of THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS and the 11th International Heating and Ventilating Exposition.

Situated in America's heartland, midway between the crowded industrial Atlantic seaboard and the towering peaks of the Rockies, is Chicago, the nation's second largest city. Surrounded by deep black soil, which stretches for hundreds of miles in every direction and makes it a great livestock and grain center, Chicago has grown from an Army outpost to a great metropolis. Started in 1803 as Fort Dearborn, by a company of soldiers under Captain John Whistler, Chicago grew with the great westward movement of the 19th Century. It became a town in 1833 and was incorporated as a city in 1837. Following the Civil War, Chicago continued its phenomenal growth as a commercial, industrial, transportation and cultural center. Today, with approximately 4,000,000 people, Chicago has grown in five generations to America's transportation center, its butcher shop and bread basket, and hub of a great industrial area making iron and steel, farm machinery, automobiles, and chemicals. Chicago is also headquarters for the country's mail order business, a leader in the printing trades and a noted convention city.

The world's largest hotel, the Conrad Hilton with 3000 rooms, plus many other hotels, offer the visitor

Typical Railroad Rates* From Chapter Cities to Chicago
(Effective October 1)

CITY	RAILROAD ROUND-TRIP	PULLMAN LOWER BERTH ONE-WAY	CITY	RAILROAD ROUND-TRIP	PULLMAN LOWER BERTH ONE-WAY
Albany	$ 70.30	$ 8.30	New Haven	$ 79.62	$ 8.90
Atlanta	48.50	8.30	New Orleans	54.85	9.95
Baltimore	65.55	8.30	New York	77.70	8.90
Boston	88.46	9.95	Norfolk	72.70	9.95
Buffalo	45.05	5.80	Oklahoma City	46.80	8.30
Charlotte	74.05	11.55	Omaha	29.05	5.80
Cincinnati	26.30	5.00	Ottawa	59.55	8.30
Cleveland	30.15	5.00	Philadelphia	70.00	8.30
Columbus	27.95	5.00	Pittsburgh	40.50	5.00
Dallas	55.70	10.25	Portland	115.00	21.00
Dayton	23.90	5.00	St. Louis	17.05	5.00
Denver	60.40	10.65	Salt Lake City	87.10	14.50
Des Moines	20.90	5.00†	San Antonio	71.00	12.80
Detroit	25.45	5.00	San Francisco	126.45	21.00
Grand Rapids	16.68	5.00	Seattle	115.00	21.00
Greensboro	45.60	9.60	Shreveport	50.10	9.60
Houston	64.70	11.95	Spokane	97.05	18.10
Indianapolis	16.68	5.00	Syracuse	57.75	6.55
Kansas City, Mo.	26.80	5.50	Toronto	41.85	5.80
Little Rock	37.45	6.55	Tulsa	41.25	8.30
Los Angeles	126.45	21.00	Vancouver	114.25	21.00
Memphis	31.80	5.80	Washington, D.C.	65.55	8.30
Minneapolis	23.75	5.00	Wichita	39.20	8.30
Montreal	65.75	8.90	Winnipeg	48.80	8.30

*Fifteen percent Federal Transportation Tax should be added to all fares and pullman rates.
†Via CRIP

a wide variety of accommodations. The Conrad Hilton will serve as headquarters for the Society's 59th Annual Meeting to be held in Chicago from January 26-29, 1953. In addition to its fine hotels, Chicago has unparalleled exhibition facilities, including the International Amphitheatre, location of the 1952 presidential conventions. Originally built in 1934, this building has recently been completely air conditioned and will serve as the site for the 11th International Heating, Ventilating, and Air Conditioning Exposition, to be held in conjunction with the Society's 59th Annual Meeting. Pres. Ernest Szekely, chairman of the Exposition Advisory Committee, has announced that the following members have accepted appointment on this Committee: Reg F. Taylor, Prof. M. K. Fahnestock, J. W. James, I. W. Cotton, S. R. Lewis, Dr. A. C. Willard, M. W. Bishop, H. R. Limbacher, J. A. Lofte, W. A. Kuechenberg, J. M. Frank, Prof. B. H. Jennings, F. P. Keeney, R. W. Keeton, M.D., and Dean L. G. Miller.

Under the direction of W. A. Kuechenberg and G. W. Bornquist, general chairman and vice chairman, respectively, of the Illinois Chapter Committee on Arrangements, plans are progressing for the various functions of the meeting, which, judging from advance reservation requests, gives every indication of being the largest ever held.

The Outer Drive Near Oak St. Beach

Members should file their special hotel reservation forms promptly as some accommodations, particularly single rooms and suites, are limited, although the Chicago hotels have reserved an adequate overall supply of rooms for the meeting.

The technical sessions promise papers on a diversity of subjects. Tentative plans call for six sessions which will include a Symposium on Odors, a Research session, a Research Administration session, and papers on solar radiation, aluminum ducts and many other subjects.

The accompanying table of rail fares gives the first class round trip fare and one-way lower berth rates to Chicago from the various Chapter cities. Come by train, come by plane or auto, but plan on coming to Chicago, in the heart of America, in January 1953.

*Summary of Chapter Meetings**

• *NORTH TEXAS*: Jack Huppert, chemical engineer with Sola Catalytic Co., gave an excellent account of the problems, procedures, and possibilities involved in a special catalytic, water treatment process. Mr. Huppert stated that when properly applied and maintained, this process could effectively prevent scale and electrolytic deterioration in most types of water systems. He added that older water treatment methods are more costly to install and maintain and are far more critical in size selection for a specified gpm flow. The speaker stated that the catalytic process described could treat water in large quantities for as little as two cents per 1000 gallons. Over or under treatment should be prevented because either could cause scaling. Proper insulation and grounding of apparatus were mentioned as having a direct bearing on the success of the process.

The August meeting was called to order by Pres. R. E. Allison in the Melrose Hotel. Attendance 85. Attendance ratio 0.42.

• *NORTHEASTERN OKLAHOMA*: The speaker of the evening was Roger P. Campbell, secretary, E. K. Campbell Co., Kansas City, Mo., who spoke on *Progress Report on the Heating of Large Spaces with Air Movement*. A question and answer period followed the talk.

The August meeting was held in the Alvin Hotel and was preceded by a social hour and dinner. During the business meeting, J. N. Watt,

*Note: The attendance ratios shown represent the membership attendance divided by the chapter membership. These ratios will be useful as a partial indication of interest shown by local chapter members in various types of subjects programmed by the various chapters and may be useful in deciding on subjects for chapter meetings.

program chairman, announced that the September meeting would feature the showing of a film entitled *Powering America's Progress*. Attendance 38. Attendance ratio 0.49.

• *NORTHEASTERN OKLAHOMA*: J. N. Watt, program chairman, introduced the speaker at the July meeting, H. M. Furtney, manager of the Electrical Division in the Oklahoma office of Wagner Electric Corp. Mr. Furtney spoke on *Application and Servicing of AC Motors on Heating, Ventilating, and Air Conditioning*.

The meeting was called to order in the University of Tulsa Student Activities Building and the minutes of the June meeting were read and approved. A report was made by Fred Colbert, chapter treasurer, followed by a discussion on membership attendance at meetings. Attendance 20. Attendance ratio 0.39.

•*SOUTH TEXAS*: The speaker at the August meeting, Norman Gauerke, was introduced by O. G. Rivoire, program chairman. Mr. Gauerke gave an interesting address on *The Human Memory and How to Improve It*.

A social hour and dinner preceded the meeting, which began with the reading and approval of the minutes of the May meeting. Following a few reports, Reg F. Taylor, nominee for president of the Society, gave a brief talk on the Society's forthcoming Annual Meeting in Chicago in January. Attendance 29. Attendance ratio 0.33.

Candidates for Membership

The Society's By-Laws require that all applications for membership or advancement are to be sent to the Executive Secretary and the names of applicants and their references shall be printed in the next issue of the JOURNAL of the Society, or mailed to all members. When the replies are received from references the Candidate's application shall be submitted to and acted upon by the Admission and Advancement Committee as soon as possible.

When the Admission and Advancement Committee has acted favorably upon a Candidate's application and assigned his grade, the Council shall confirm the election of the proposed Candidate for membership. During the past month there have been 43 applications for membership, including 1 reinstatement; in addition 9 advancements have been received. The names of these men and their sponsors are published in the following list.

Members are requested to scrutinize the list with care. The Admission and Advancement Committee, and in turn, the Council, urge members to assume their share of responsibility of receiving these candidates into membership by advising the Executive Secretary promptly of any whose eligibility for membership is in any way questioned.

All correspondence in regard to such matters is strictly confidential, and is solely for the good of the Society, which it is the duty of every member to promote.

Unless objection is made by some member by October 31, 1952, these candidates will be voted upon by the Council. Those elected to membership will be notified by the Executive Secretary immediately after election.

Note: †Reinstatement. *Non-member. △Advancement.

Alabama

HOENE, L. E., Vice Pres., The George F. Wheelock Co., Birmingham. REFERENCES: R. B. Dowdy, H. H. Feaster, H. K. Walden, W. B. Yarbrough.

MINTON, C. R., Sales Engr., Electric Department, City of Decatur, Decatur. REFERENCES: S. H. Akcer*, F. J. Lewis*, T. W. Newberry*, M. H. Wilson*.

Arkansas

THALMUELLER, J. E., Chief Engr., Malco Theatres, Little Rock. REFERENCES: R. E. Blaylock, W. J. Franklin, L. S. Houston, C. H. Miller.

California

AINSWORTH, K. H., Jr. Mech. Engr., State of California, Div. of Architecture, Sacramento. REFERENCES: Harold Hayes*, A. J. Hess, Arthur Roth, Norman Sharpe.

BLACKMAN, D. M., Repr., Owens-Corning Fiberglas Corp., Sacramento. REFERENCES: H. F. Boothby*, Walter Johnson*, E. C. McKinsey, R. A. Sarro.

△BLOXHAM, A. T., Repr., Joy Manufacturing Co., San Francisco. REFERENCES: C. W. Lockhart, J. D. Mitchell, N. H. Peterson, S. W. Terry.

BRAINARD, H. D., Plbg. & Htg. Dept. Mgr., Crane Co., Sacramento. REFERENCES: Herbert Lemkau, J. E. Marshall, L. A. O'Meara, N. H. Peterson.

CAREY, G. S., Owner, Grant S. Carey, Heating, Ventilating, Air Conditioning, Auburn. REFERENCES: J. E. Day, Donald Dickson*, J. E. Marshall, L. A. O'Meara.

GAUDETTE, H. J., Branch Mgr., General Controls Co., Sacramento. REFERENCES: J. E. Day, W. C. Denner, T. W. Johnston*, R. Lukey*.

MCGREW, GEORGE, Supt., Dunphy Sheet Metal Products, Sacramento. REFERENCES: W. C. Denner, S. W. Doolittle, E. E. Phillips, R. A. Sarro.

MORRIS, A. E., Sr. Engr., Risley & Gould, Los Angeles. REFERENCES: C. A. Drace*, E. B. Hilton*, Don Nack*, C. D. Walz.

PELLICCIOTTI, DAN, Owner-Manager, Oroville Plumbing, Heating and Air Conditioning, Oroville. REFERENCES: A. J. Hess, H. E. Muldoon, L. A. O'Meara, N. H. Peterson.

PHILLIPS, R. E., JR., Vice Pres., Ralph E. Phillips, Inc., Los Angeles. REFERENCES: A. J. Hess, R. E. Phillips, W. O. Stewart, L. H. Wagenbrenner.

SHONFELD, T. H., Vice Pres., Baker Engineering Corp., Los Angeles. REFERENCES: A. P. Hawgood*, C. E. Hollingworth, Stanley Polland, Andrew Randkler*.

STECHER, L. S., Sr. Mech. Engr., State of California, Div. of Architecture, Sacramento. REFERENCES: S. W. Doolittle, N. W. Downes, J. E. Marshall, L. A. O'Meara.

THOMAS, R. E., Partner, Delius & Thomas, Engineers, San Francisco. REFERENCES: K. O. Alexander, R. E. Conner, R. B. Holland, G. J. Yamas.

WAYDELICH, J. C., Chief Project Engr., Baker Engineering Corp., Los Angeles. REFERENCES: L. D. Fisher*, C. E. Hollingworth, T. H. Shonfeld*, N. S. Templin*.

Florida

ALWARD, H. F., Heating and Air Conditioning Engr., Quality Products Distributors, Inc., Sarasota. REFERENCES: R. S. Clark, J. P. Griffin, R. A. Menendez, T. R. Yarborough.

IREY, R. C., Mech. Designer, Rader Engineering Co., Miami. REFERENCES: C. O. Grannis*, J. W. Greenleaf*, V. F. Self, M. J. Wilson.

Georgia

HAIRSTON, G. E., Owner, Hairston & Co., Atlanta. REFERENCES: S. W. Boyd, E. W. Klein, Jr., D. G. Lindstrom, F. A. Player.

Illinois

BASSETT, W. M., Asst. to Engr. in Charge, Pump Div., Bell & Gossett Co., Morton Grove. REFERENCES: Edward Bouse*, R. W. Janetz*, H. A. Lockhart, L. B. Oosten.

△HATTIS, B. S., Partner, Robert E. Hattis, Cons. Engr., Chicago. REFERENCES: S. L. Haas, Herbert Kreisman, S. R. Lewis, L. L. Narowetz.

SCHAIBLE, K. C., Sales Engr., Powers Regulator Co., Chicago. REFERENCES: C. A. Gustafson, J. A. Oberlin, K. M. Stevens, F. E. Zimmerman.

Louisiana

CASTIGLIONE, C. B., District Mgr., Marshall, Neil & Pauley, Inc., New Orleans. REFERENCES: L. W. Bryant*, J. F. Marshall, F. M. Neil, W. N. Pauley.

△CLAY, W. L., Sales Engr., Gulf Engineering Co., Inc., New Orleans. REFERENCES: Ralph Elizardi, G. E. May, W. G. Moses, Theodore Offner.

Massachusetts

LYNCH, J. D., Estimator, Charles P. Blouin, Inc., Cambridge, Mass. REFERENCES: D. W. Blair, P. A. L. Foulds, J. M. Means, F. A. Merrill.

Michigan

IRELAND, R. D., Sales & Service Engr., Bundy Tubing Co., Detroit, Mich. REFERENCES: R. Daligga*, A. A. Folgart*, R. H. Hobrock*, G. S. Wiley*.

Missouri

△GAINES, E. F., Pres., Home Conditioning Co., Joplin. REFERENCES: J. T. Jones, H. D. Rainey, H. A. Satterlee, Monte Taylor.

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Chile

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OBITUARIES

CHAUNCEY L. CHASE
New York, N. Y.

C. L. Chase, consulting engineer, New York, and member of the Society since 1931, died on August 1, 1952.

Mr. Chase was born on July 10, 1893, in Milo, Me., and attended the University of Maine. From 1915-19 he was employed as a draftsman and designer with Remington Arms Co., and later with Columbia Graphophone Co., both of Bridgeport, Conn. Mr. Chase joined W. G. Cornell Co., New York City, in 1919 as a heating and ventilating engineer, and from 1922-25 was with Dwight P. Robinson Co., Inc., engineers and constructors, New York City, as a designer and checker. For the next four years, he was engaged in heating and ventilating design work for

the Socony Burner Corp., Starrett & Van Vleck, and Gibbs & Hill, consulting engineers, all of New York City. From 1931 until the time of his death, he was engaged in consulting engineering work either in partnership or on his own.

The Officers and Council extend their sincere sympathy to Mr. Chase's widow, Mrs. Jane Chase.

MARIO C. GIANNINI
New York, N. Y.

M. C. Giannini, former assistant dean of the College of Engineering, New York University, died suddenly in Winter Park, Fla., on August 24.

Born in New York City, Professor Giannini attended New York University, receiving his B.S. and M.S. degrees in mechanical engineering in 1923 and 1926, respectively. Professor Giannini's first position was as draftsman and estimator for the A. Custodis Chimney Co., after which he joined the consulting firm of Tenney and Ohmes, Inc., as a design engineer.

In 1926 he became a member of the faculty of the New York University evening Engineering Division, and in 1931 accepted a full time position on the faculty in the day session of the College of Engineering. Professor Giannini was made

M. C. Giannini
New York, N. Y.

associate professor of mechanical engineering in 1934 and in 1946 was appointed as executive assistant for the College of Engineering. He was named assistant dean of the College in 1949 and retired in June of this year because of poor health. He also carried on private consulting practice since 1931.

During World War II Professor Giannini served as director of New York University Engineering, Science and Management War Training Program and as technical advisor of the Division of Visual Education of the United States Office of Education. In the latter capacity he assisted in the preparation of war training films.

Professor Giannini joined the Society in 1945 and was active in Society affairs, serving on the Publication Committee, the Committee on Research, and the TAC on the Heat Pump. He served as vice chairman of the Committee on Arrangements and as chairman of the Entertainment Committee during the 52nd Annual Meeting in New York. He was president of the New York Chapter in 1947-48 and was a nominee for Council in 1949 but ill health forced his withdrawal.

He also belonged to the *American Society for Engineering Education* and was a member of Tau Beta Pi and Pi Tau Sigma, honorary engineering fraternities.

Surviving are his wife, Mrs. Elizabeth Giannini, a daughter, two sons and two brothers, to whom the Officers and Council of the Society offer their sincere sympathy.

IRVING C. BAKER
Dayton, Ohio

I. C. Baker, vice president, Airtemp Division, Chrysler Corp., Dayton, died of a heart attack suffered at his home on August 10.

Mr. Baker was born on January 28, 1892, in Fremont, Neb., and attended the University of Nebraska, from which he received a B.S. in mechanical engineering. From 1915-17 he was associated with American Blower Co., Detroit, in the Engineering and Air Conditioning Contract Departments. During World War I, Mr. Baker served as an officer in the United States Army as chief engineer of the Motor Transport Base Shops, Baltimore. Between 1921-22 he served as assistant secretary of the Society in which capacity he prepared much of the text for the first ASHVE GUIDE published in 1922. He rejoined American Blower Co., Detroit, in 1922, and from 1927 to 1931 was with York Ice Machinery Corp., York, Pa., as general sales manager. Mr. Baker joined Chrysler's Airtemp Division in 1935, when it was organized, and at the time of his death was also vice president of the Airtemp Construction Corp. and the Airtemp Sales Corp.

He was a member of the White Rose Masonic Blue Lodge of York,

I. C. Baker
Dayton, Ohio

Pa., and of the Sigma Tau engineering fraternity.

The Society's Officers and Council extend sincere sympathy to his widow and the other members of his family.

WILLIAM C. WATT
Toronto, Canada

W. C. Watt, mechanical superintendent of the Robert Simpson Co., Toronto, died suddenly on August 4 in Toronto Western Hospital. Mr. Watt was born in Turriff, Aberdeenshire, Scotland, on June 4, 1901, and attended technical schools there.

He was first employed by the National Textiles, Ltd. after which he joined Willard Chocolates, as mechanical superintendent from 1931-40. Between 1940 and 1945 Mr. Watt was associated with the Dominion Government Department of Munitions and Supply. At the end of the war he joined the Robert Simpson Co., by whom he was employed until his death.

He was also a member of Delta Masonic Lodge, the St. Andrew's Society of Toronto, the Toronto Scottish Club and the Engineer's Club of Toronto. Mr. Watt in addition was secretary-treasurer of the Toronto Branch of the *Engineering Institute of Canada*.

Mr. Watt is survived by his widow, a son and daughter to whom the Officers and Council extend their deep sympathy.

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OFFICERS OF CHAPTERS AND BRANCHES

(49 Chapters—11 Student Branches)

Date indicates year organized; an address and no city shown signifies same city as headquarters; numeral in parentheses indicates zone.

• **ARKANSAS:** 1952. Hdqrs., Little Rock, Ark. Meets, Third Tuesday. PRESIDENT, E. N. Pettit, Jr., 904 Wallace Bldg. SECRETARY, R. E. Blaylock, 509 E. Markham St.

• **ATLANTA:** 1937. Hdqrs., Atlanta, Ga. Meets, Second Monday. PRESIDENT, F. A. Player, 2110 Peachtree Rd., N. W. SECRETARY, J. M. Lazenby, 2641 Merry Lane, N. E., (6).

• **BALTIMORE:** 1949. Hdqrs., Baltimore, Md. Meets, Third Wednesday. PRESIDENT, E. R. Kent, 2322 N. Charles St. (18). SECRETARY, A. M. Kroft, 3935 Stokes Dr. (29).

• **BRITISH COLUMBIA:** 1952. Hdqrs., Vancouver, B.C., Canada. PRESIDENT, M. E. Minaker, 1128 Burrard St. SECRETARY, D. W. Thomson, 445 Richards St.

• **CENTRAL NEW YORK:** 1944. Hdqrs., Syracuse, N. Y. Meets, Fourth Wednesday. PRESIDENT, F. E. Krell, 116 Fernwood Ave. (5). SECRETARY, H. K. Ormsby, 205 S. Townsend St. (2).

• **CENTRAL OHIO:** 1944. Hdqrs., Columbus, Ohio. Meets, Third Monday. PRESIDENT, A. D. Bogen, 550-54 E. Livingston Ave. (15). SECRETARY, J. A. Guy, 219 King Ave. (1).

• **CINCINNATI:** 1932. Hdqrs., Cincinnati, Ohio. Meets, First Tuesday. PRESIDENT, H. E. Russell, 4th & Main Sts., Box 960. SECRETARY, F. W. Wilson, 222-24 E. 14th St.

• **CONNECTICUT:** 1940. Hdqrs., New Haven, Conn. Meets, Third Thursday. PRESIDENT, T. L. Arnold, 26 Francis Ave., Hartford (6). SECRETARY, C. L. L'Hommedieu, 76 Blatchley Ave.

• **DELTA:** 1939. Hdqrs., New Orleans, La. Meets, Third Tuesday. PRESIDENT, Walter Cooke, 816 Howard Ave. (13). SECRETARY, T. J. Jenny, 1000 S. Peters St. (9).

• **EMPIRE STATE CAPITAL:** 1951. Hdqrs., Albany, N. Y. PRESIDENT, Harry Horowitz, 889 Warren St. (3). SECRETARY, R. J. Tougher, Menands Rd., Loudonville, N. Y.

• **GOLDEN GATE:** 1937. Hdqrs., San Francisco, Calif. Meets, First Thursday. PRESIDENT, T. J. White, 625 Market St. (5). SECRETARY, Eric Roberts, 417 Market St. (5).

• **ILLINOIS:** 1906. Hdqrs., Chicago, Ill. Meets, Second Monday. PRESIDENT, M. W. Bishop, Rm. 1504, 228 N. LaSalle St. (1). SECRETARY, G. V. Zintel, 1217 W. Washington Blvd. (7).

• **INDIANA:** 1943. Hdqrs., Indianapolis, Ind. Meets, Fourth Tuesday. PRESIDENT, J. T. Hardin, 720 Noble St. (2). SECRETARY, P. O. Patterson, 6300 N. Oakland Ave. (18).

• **INLAND EMPIRE:** 1950. Hdqrs., Spokane, Wash. Meets, First Friday after First Tuesday. PRESIDENT, T. P. Nau, S. 1419 Walnut (9). SECRETARY, H. A. Bickel, E. 7 Riverside Ave.

• **IOWA:** 1940. Hdqrs., Des Moines, Ia. Meets, Second Tuesday. PRESIDENT, R. H. Schneil, 1617 33rd St. (11). SECRETARY, Bowen Campbell, 1435 Cassady Dr. (3).

• **KANSAS:** 1951. Meets, Tuesday after First Monday. Hdqrs., Wichita, Kan. PRESIDENT, O. P. Bullock, 254 Laura (7). SECRETARY, H. D. Speyer, 120 Ida.

• **KANSAS CITY:** 1917. Hdqrs., Kansas City, Mo. Meets, First Monday. PRESIDENT, W. A. Reichow, 1621 E. 31st St. (3). SECRETARY, J. G. Barnes, Jr., 1924 Oak St.

• **MANITOBA:** 1935. Hdqrs., Winnipeg, Man., Canada. Meets, Third Thursday. PRESIDENT, W. J. Atkinson, 812 Boyd Bldg. SECRETARY, Ernest Lambert, 93 Lombard St.

• **MASSACHUSETTS:** 1912. Hdqrs., Boston, Mass. Meets, Third Tuesday. PRESIDENT, G. B. Torrens, 15 Alden Lane, Shrewsbury. SECRETARY, G. D. Fife, Rm. 606, 79 Milk St. (9).

• **MEMPHIS:** 1944. Hdqrs., Memphis, Tenn. Meets, Third Monday. PRESIDENT, W. L. Drake, 15 N. Reese. SECRETARY, A. T. Bevil, 212 Robinson Bldg., 160 Union (3).

• **MIAMI VALLEY:** 1950. Hdqrs., Dayton, Ohio. Meets, First Wednesday. PRESIDENT, D. L. Bergman, Box 95, Riverdale Sta. (5). SECRETARY, D. E. Tullis, 1720 Park Pl. (6).

• **MICHIGAN:** 1916. Hdqrs., Detroit, Mich. Meets, First Monday after 10th of month. PRESIDENT, C. A. Strand, 9117 Hamilton Ave. (2). SECRETARY, D. S. Falk, 4864 Woodward Ave. (1)

• **MINNESOTA:** 1918. Hdqrs., Minneapolis, Minn. Meets, First Monday. PRESIDENT, William Sturm, 2160 Highland Pkwy., St. Paul (5). SECRETARY, J. G. Hamm, 850 Cromwell Ave., St. Paul (4).

• **MONTREAL:** 1936. Hdqrs., Montreal, Que., Canada. Meets, Third Monday. PRESIDENT, W. G. Hole, 7035 Grand Ave. (14). SECRETARY, D. L. Lindsay, 1411 Crescent St. (25).

• **NEBRASKA:** 1940. Hdqrs., Omaha, Neb. Meets, Second Tuesday. PRESIDENT, S. W. Black, 18th & Harney Sts. SECRETARY, H. H. Ulrich, 507 City Hall (2).

• **NEW YORK:** 1911. Hdqrs., New York, N. Y. Meets, Third Monday. PRESIDENT, P. B. Gordon, 222 E. 41st St. (17). SECRETARY, Carl H. Flink, 62 Worth St. (13).

• **NORTH TEXAS:** 1938. Hdqrs., Dallas, Tex. Meets, Third Monday. PRESIDENT, R. E. Allison, 607-11 First Ave. (10). SECRETARY, M. W. Brown, 1213 Texas Bank Bldg. (2).

• **NORTHWESTERN OKLAHOMA:** 1948. Hdqrs., Tulsa, Okla. Meets, Second Tuesday. PRESIDENT, C. H. Dollmeyer, Jr., 1533 N. New Haven Ave. (15). SECRETARY, V. W. Miles, 624 So. Boston Ave., Box 871.

• **NORTHERN OHIO:** 1916. Hdqrs., Cleveland, Ohio. Meets, Second Monday. PRESIDENT, R. E. Sherman, 570 Hanna Bldg. (15). SECRETARY, R. G. Huebscher, 7218 Euclid Ave. (3).

• **NORTHERN PIEDMONT:** 1952. Hdqrs. Greensboro, N.C. PRESIDENT, L. L. Vaughan, P.O. Box 5746, Raleigh. SECRETARY, J. W. Bunn, Jr., 2705 Lochmore Dr., Raleigh.

• **OKLAHOMA:** 1935. Hdqrs., Oklahoma City, Okla. Meets, Second Monday. PRESIDENT, W. J. Collins, Jr., 1708 Westminster Pl. SECRETARY, F. X. Loeffler, Jr., 1604 N. W. Fifth St.

• **ONTARIO:** 1922. Hdqrs., Toronto, Ont., Canada. Meets, First Monday. PRESIDENT, J. H. Ross, 1251 Yonge St. SECRETARY, H. R. Roth, 57 Bloor St., W.

• **OREGON:** 1939. Hdqrs., Portland, Ore. Meets, Thursday after First Tuesday. PRESIDENT, K. H. Hanson, 104 S.E. Seventh (14). SECRETARY, W. R. Norte, 2225 N.E. Broadway (12).

• **PACIFIC NORTHWEST:** 1928. Hdqrs., Seattle, Wash. Meets, Second Tuesday. PRESIDENT, W. B. Pride, 3111 Dose Ter. (44). SECRETARY, I. L. Winsor, 105 Orcas St. (8).

• **PHILADELPHIA:** 1916. Hdqrs., Philadelphia, Pa. Meets, Second Thursday. PRESIDENT, M. E. Barnard, 12 S. 12th St. (7). SECRETARY, C. J. Lubking, 5060 Wayne Ave.

• **PITTSBURGH:** 1919. Hdqrs., Pittsburgh, Pa. Meets, Third Monday. PRESIDENT, B. B. Reilly, Fifth & Liberty Aves. (22). SECRETARY, E. H. Riesmeyer, Jr., 231-33 Water St. (22).

• **ROCKY MOUNTAIN:** 1944. Hdqrs., Denver, Colo. Meets, First Wednesday. PRESIDENT, N. H. Brickham, 2715 S. Humboldt St. (10). SECRETARY, A. S. Widdowfield, 1925 Blake St. (2).

• **ST. LOUIS:** 1918. Hdqrs., St. Louis, Mo. Meets, Second Tuesday. PRESIDENT, L. L. Hamig, 1706 Olive St. (3). SECRETARY, J. F. Naylor, Jr., 2335 S. Grand Ave. (4).

• **SHREVEPORT:** 1948. Hdqrs., Shreveport, La. Meets, Third Thursday. PRESIDENT, E. M. Hood, 411 Louisiana Ave. SECRETARY, M. A. Hudson, 4609 Gilbert Dr.

• **SOUTH TEXAS:** 1938. Hdqrs., Houston, Tex. Meets, Third Friday. PRESIDENT, C. L. Fleming, 809 M. & M. Bldg. SECRETARY, J. W. Holland, 245 Esperson Bldg. (2).

• **SOUTHERN CALIFORNIA:** 1930. Hdqrs., Los Angeles, Calif. Meets, First Tuesday. PRESIDENT, J. S. Earhart, 2734 Fleur Dr., San Marino (9). SECRETARY, C. D. Walz, 3600 San Pasqual St., Pasadena (10).

• **SOUTHERN PIEDMONT:** 1952. Hdqrs. Charlotte, N.C. PRESIDENT, R. M. Warren, Jr., P.O. Box 1755, Charlotte. SECRETARY, J. A. Rice, P.O. Box 1755, Charlotte.

• **SOUTHWEST TEXAS:** 1946. Hdqrs., San Antonio, Tex. Meets, Third Tuesday. PRESIDENT, W. E. Long, Dept. of Mechanical Engrg., University of Texas, Austin. SECRETARY, L. H. Hornor, Jr., 810 Insurance Bldg.

• **UTAH:** 1944. Hdqrs., Salt Lake City, Utah. Meets, Third Thursday. PRESIDENT, D. R. Wilde, 2634 S. 19th E. (1). SECRETARY, Alfred Richeda, P.O. Box 479 (9).

• **VIRGINIA:** 1946. Hdqrs., Norfolk, Va. Meets, Third Wednesday. PRESIDENT, D. E. Phillips, P. O. Box 674, Newport News. SECRETARY, H. E. Marquart, 111 W. Main St. (10).

• **WASHINGTON, D. C.:** 1935. Hdqrs., Washington, D. C. Meets, Second Wednesday. PRESIDENT, G. R. Walz, 5214 25th Pl. N., Arlington (7) Va. SECRETARY, W. C. Reamy, Jr., 17th & Pennsylvania Ave., N.W. (6).

• **WESTERN MICHIGAN:** 1931. Hdqrs., Grand Rapids, Mich. Meets, Second Monday. PRESIDENT, H. R. Limbacher, 760 E. Vine St., Kalamazoo. SECRETARY, F. K. Platt, P.O. Box 307, Kalamazoo.

• **WESTERN NEW YORK:** 1919. Hdqrs., Buffalo, N. Y. Meets, Second Monday. PRESIDENT, J. M. Quackenbush, 505 Franklin St. (2). SECRETARY, Q. P. Thompson, 360 Richmond Ave. (22).

• **WISCONSIN:** 1922. Hdqrs., Milwaukee, Wis. Meets, Third Monday. PRESIDENT, J. A. Lofte, 2505 N. 97th St., Wauwatosa (10). SECRETARY, I. J. Rossiter, 231 W. Wisconsin (3).

STUDENT BRANCHES

• **COLLEGE OF CITY OF NEW YORK:** 1949. Hdqrs., New York, N. Y.

• **LOUISIANA POLYTECHNIC INSTITUTE:** 1949. Hdqrs., Ruston, La. PRESIDENT, W. G. McMullen, Box 472, Tech Station. SECRETARY, R. L. Gorton, Box 184, Tech Station.

• **NORTH CAROLINA STATE COLLEGE:** 1948. Hdqrs., Raleigh, N. C. PRESIDENT, Sydney Narvey, 5-B Vetville, State College Station. SECRETARY, E. A. Travis, Jr., P.O. Box 5333, Bagwell Dormitory.

• **OKLAHOMA A. & M. COLLEGE:** 1950. Hdqrs., Stillwater, Okla. PRESIDENT, Stuart Cohen, 513 ½ Knoblock. SECRETARY, H. G. Rice, 5 Chickasha, Box 417, Vets Village.

• **OREGON STATE COLLEGE:** 1949. Hdqrs., Corvallis, Ore. Meets, First Wednesday after First Tuesday. PRESIDENT, D. W. Blair, 223 W. 15th St. SECRETARY, C. D. Cannon, 404 N. 26th St.

• **PURDUE UNIVERSITY:** 1948. Hdqrs., W. Lafayette, Ind. CHAIRMAN, N. J. Kirch, 922 Highland Ave., Lafayette. SECRETARY, H. F. Allen, Jr., 629 University St.

• **TEXAS A. & M. COLLEGE:** 1946. Hdqrs., College Station. Meets, Second and Fourth Tuesday. PRESIDENT, J. O. Kadel, Box 4054. SECRETARY, W. C. Haggard, Box 5227.

• **UNIVERSITY OF DETROIT:** 1949. Hdqrs., Detroit, Mich. Meets, First Tuesday. PRESIDENT, T. J. Feahney, Jr., 18263 Oak Dr. (21). SECRETARY, W. F. Thull, 18313 New Jersey (19).

• **UNIVERSITY OF KANSAS:** 1949. Hdqrs., Lawrence, Kans. Address mail to Dr. Warren E. Snyder, chairman, Dept. of Mechanical Engineering, University of Kansas.

• **UNIVERSITY OF TEXAS:** 1949. Hdqrs., Austin, Tex. Meets, First and Third Tuesday. PRESIDENT, W. A. Cox, 360-D Deep Eddy Apts. SECRETARY, V. H. Miles, PHP Dorm J.

• **UNIVERSITY OF TORONTO:** 1951. Hdqrs., Toronto, Ont. CHAIRMAN, J. A. Slemin, 21 Wilberton Rd. SECRETARY, T. O. Smith, 455 Avenue Rd.

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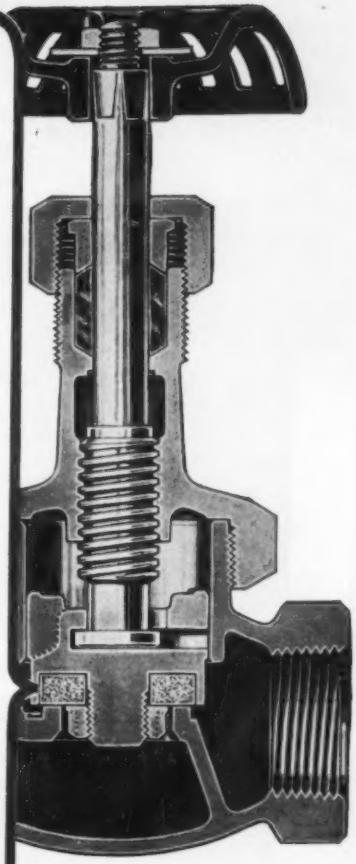

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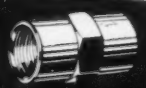

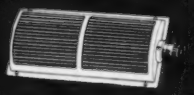

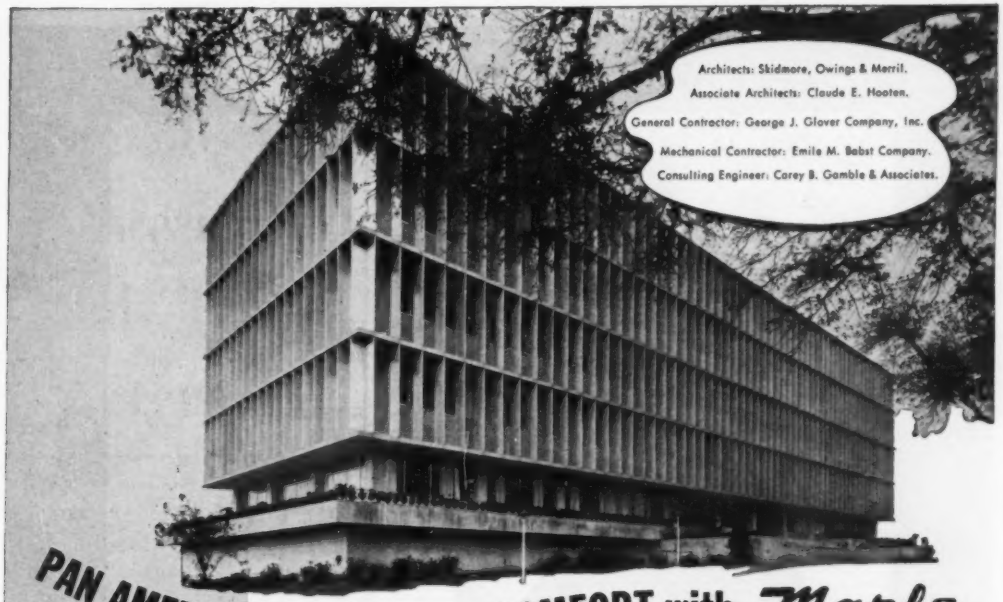
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Associate Architects: Claude E. Hooten.
General Contractor: George J. Glover Company, Inc.
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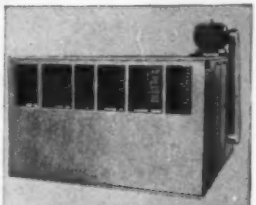

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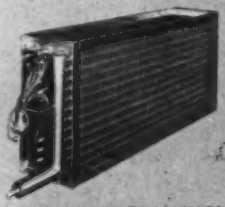

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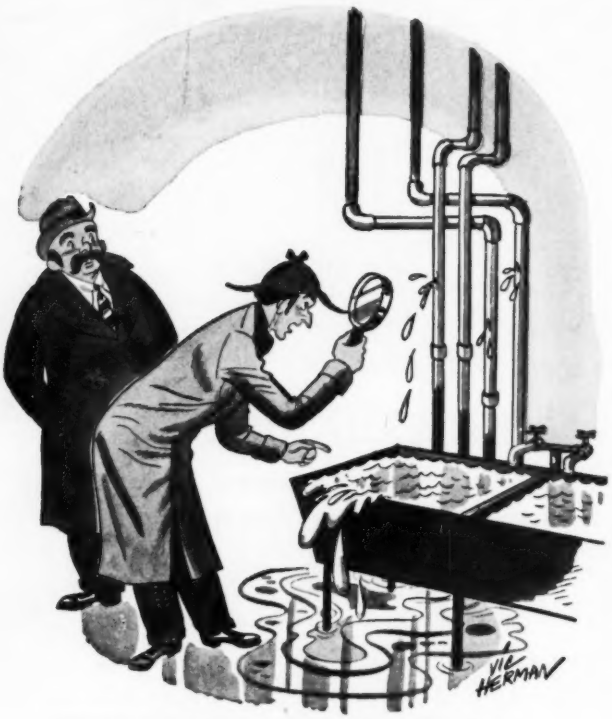

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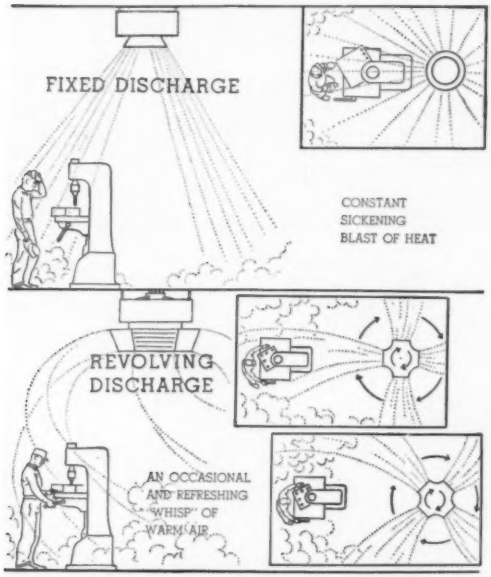

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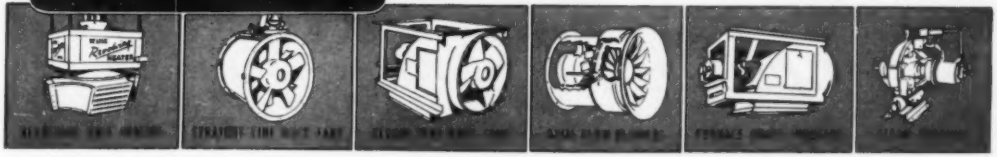

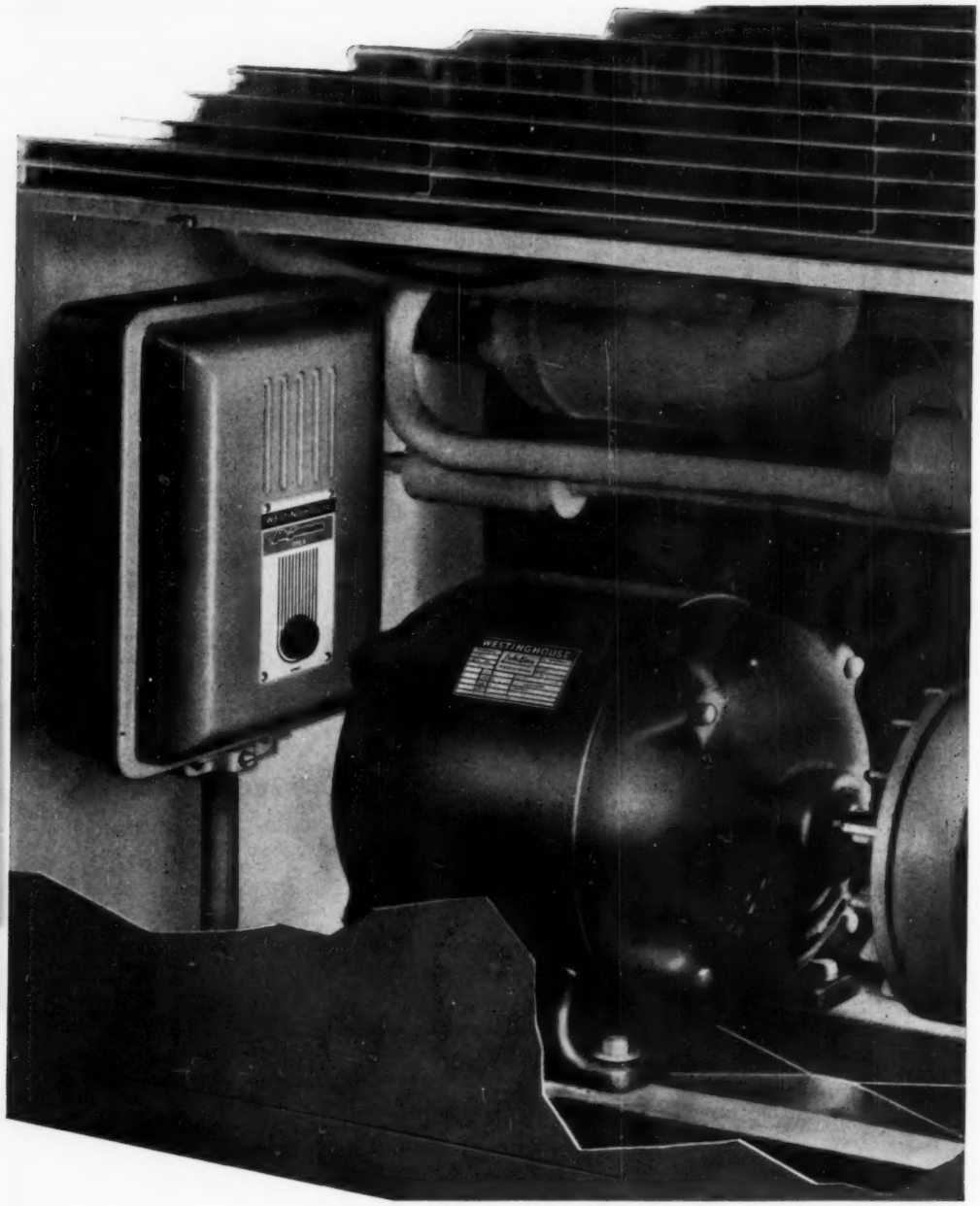

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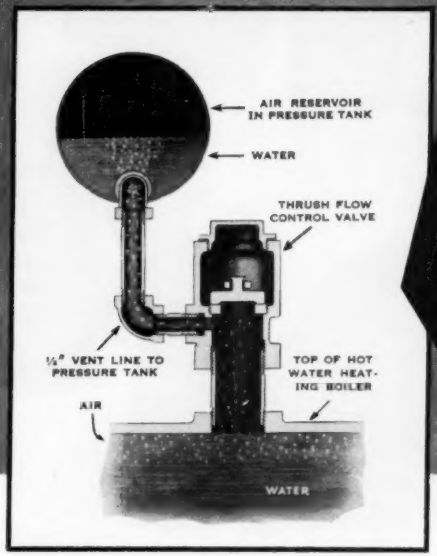

HAVING TROUBLE with air in hot water heating systems? Then you need Thrush Flow Control Valves with air tubes. Even a little air reduces efficiency of convectors, radiators or coils because of the limited volume of water in a modern hot water heating system. Air from the boiler passes up outside the air tube into the Thrush Flow Control Valve and is kept out of the system.

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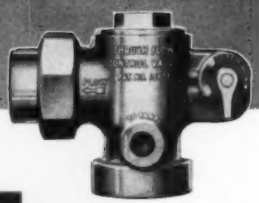
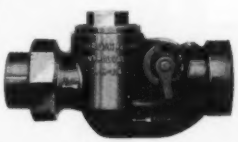


Angle Flow Control Valve

Vertical Flow Control Valve with air tube

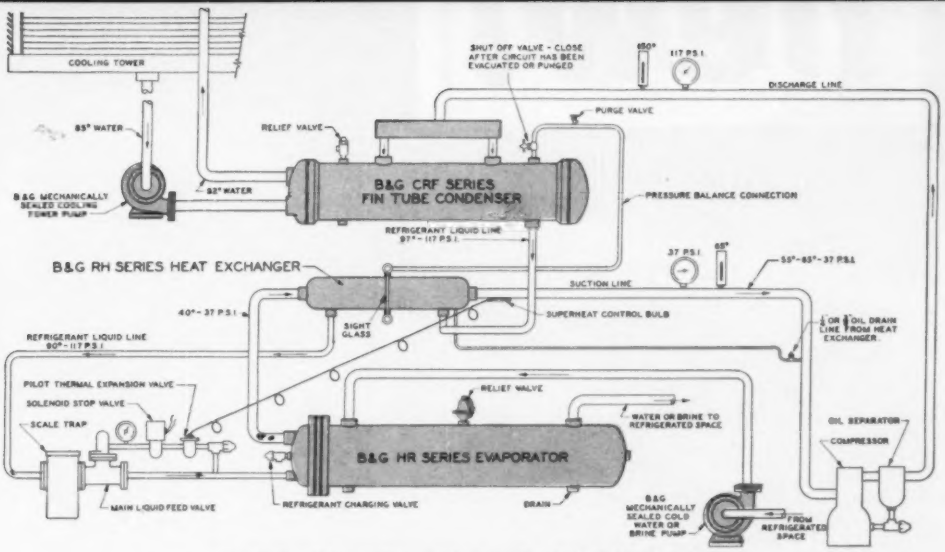
Horizontal Valve for zoning



Thrush Water Circulator

H. A. **THRUSH** & COMPANY
PERU • INDIANA

Matched UNITS FOR *Matchless* PERFORMANCE



Typical refrigeration system, using B & G Equipment

By specifying B & G Refrigeration Equipment throughout you receive the benefits of a completely integrated installation . . . plus the advantage of a guarantee from a *single* manufacturer.

B & G Condensers, Evaporators and Heat Exchangers are designed to deliver maximum tonnage with minimum operating expense. These units give long, trouble-free service—*because they are built right*—and have proved it in the field. You'll be particularly interested in the design of the B & G Evaporator, which prevents oil-trapping in the head passes—a warranty of more efficient and dependable performance.

As for pumps, you can spot superiority the moment you lay eyes on a B & G Series 1522 UNIBUILT. Among the many features of this pump are the leak-proof Mechanical Seals—hydraulically and dynamically balanced impellers—standard motors and interchangeable parts.

Send today for a complete file of B & G Catalogs.

. . .and doing more than ever before

Here's the last word in low-cost, space-saving, along-the-wall heating. Dunham's new Fin-Vector Radiation fits in functionally almost anywhere . . . in any type of building . . . at any height along outside walls.

Light in weight . . . but long on performance . . . Fin-Vector goes up fast, distributes heat evenly in long runs, looks like new . . . works like new . . . even after years of hard knocks.

Cover sections lock neatly together into one long cabinet. Choice of sloping top, flat top, or expanded metal covers; full line of accessories for a sturdier, better looking, better heating installation.

Send For Free Literature. Data Sheets 1256-61 fully describe and illustrate Fin-Vector features, capacities and types. Please write for your free copies to Dept. 2, C.A. Dunham Company, 400 W. Madison St., Chicago 6, Illinois.

DUNHAM **FIN-VECTOR RADIATION**

ANOTHER QUALITY PRODUCT OF C. A. DUNHAM COMPANY • CHICAGO • TORONTO • LONDON

MAINTENANCE CUT When Pump and Motor Use Same Frame and Shaft

ELIMINATE TROUBLES caused by misalignment . . . excessive wear of bearings, packing, and couplings. For lower maintenance, standardize on Allis-Chalmers package pumps . . . the pump with permanent alignment built in.

The complete pumping unit comes to you in one piece. Simply bolt it to the floor, connect power and piping, and you're ready to pump. No special foundation, no couplings or extra parts required.

Both motor and pump are designed together . . . built together by Allis-Chalmers. And there's a nation-wide chain of Certified Service Shops to back up your installations. Built in sizes from 10 to 500 gpm; heads to 220 ft.

Call your nearby Allis-Chalmers distributor or district office. Or write Allis-Chalmers, Milwaukee 1, Wisconsin.

A-3872

Electrifugal is an Allis-Chalmers trademark.

ALLIS-CHALMERS

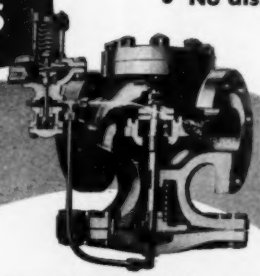
NEW PUMP FILMS

See new series of 3 sound-slide films, widely praised by educational and industrial groups. Get practical, instructive information on theory, application, installation and maintenance of centrifugal pumps. Series is designed for showing to maintenance meetings, plant groups, and engineering societies. Arrange now for a showing! Call your nearby Allis-Chalmers authorized distributor or district office. Or write Allis-Chalmers, Milwaukee 1, Wis.

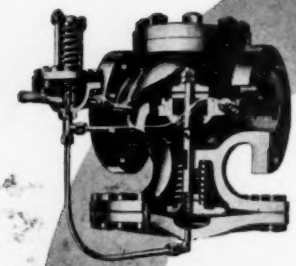
SAVE WITH SPENCE on all these jobs

Here are a few reasons why Spence Regulators give you accurate regulation and long, trouble-free life:

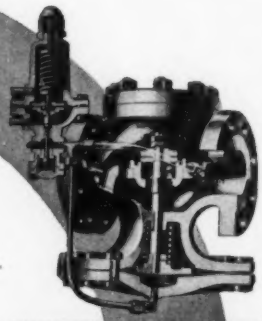
- **Single-seat Packless Construction**
- **Large Balanced Metal Diaphragm**
- **Sensitive Pilots**
- **SECO Metal Seats and Discs**
- **Springs out of path of steam**
- **No dismantling for inspection**



PRESSURE REDUCING—Self-operated, dead-end regulators powered by large, frictionless, metal diaphragms. Sizes ¼ in. to 12 in. Pressures to 600 psi 750 F.

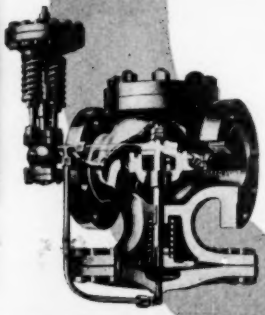


BACK PRESSURE CONTROL—Wide selection of sensitive pilots to meet exacting requirements. Initial pressure closing, guaranteed to shut tight. Packless construction, metal diaphragms.

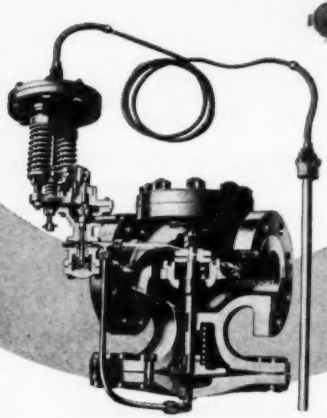


DIFFERENTIAL PRESSURE—Accurate control of delivery pressure at a constant, adjustable differential from 3 to 150 psi above another source of fluid pressure.

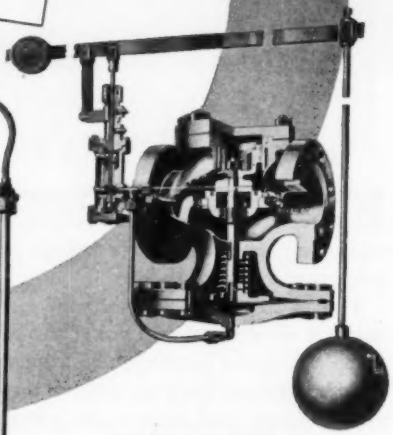
WRITE FOR BULLETIN 350
for complete details on Spence's line of automatic regulating valves



PUMP GOVERNOR—Constant or excess pressure control for steam pumps. Steam pressures to 600 psi 750 F, pump discharge pressures to 2000 psi.



TEMPERATURE REGULATING—Combined temperature and pressure control. No separate reducing valve required. Shuts tight, will not wiredraw or be damaged by overheating. Sizes to 12 in.

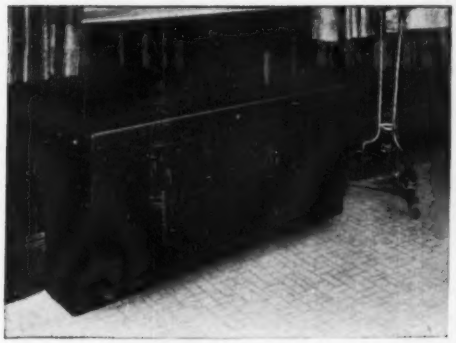


LEVER OPERATED—Pilot lever for connection by cable or mechanical linkage to floats or other devices. Slight actuator motion opens and closes main valve.

SE-113

SPENCE ENGINEERING COMPANY, INC.
WALDEN, NEW YORK

Spence

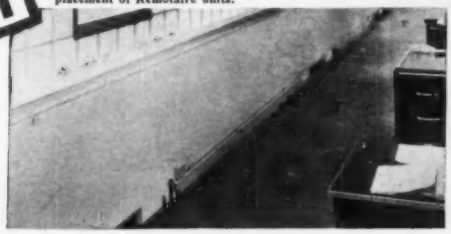


Summer cooling... winter heating

MODERNIZATION
made easy with
THE REMOTAIRE
an individual room, remote type unit providing year 'round air conditioning

1

Actual installation scene in large industrial office building showing arrangement of piping and ventilation aperture before placement of Remotaire units.



2

View of Remotaires with front covers removed. Large open area such as this can be partitioned into small offices, each with an individually controlled Remotaire unit.

3

View of building showing ventilator apertures as they look from the street. Ventilation air can be supplied by several other methods, if desired.

THE Remotaire by American-Standard provides efficient, economical all-weather air conditioning for hotels, motels, apartments, schools, office and industrial buildings, and other types of multi-room installations.

The Remotaire is ideal for new construction as well as modernization. It uses chilled water from a central water chiller for cooling and warm water from a central heating plant for heating. Ventilation comes from a small wall aperture behind each unit, thus eliminating use of large, expensive, space-consuming ductwork. For descriptive literature, write for Form No. 298. **American Radiator & Standard Sanitary Corporation**. Dept., HP-102, Pittsburgh 30, Pa.

Designed for simplified economical installation . . .

1. Four standard control packages are available.

2. Coil designed for right or left hand connections. Easily reversed if necessary.

3. Exceptionally quiet fans and acoustically-treated air passages.

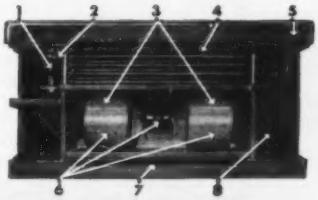
4. Coil shield over the top of coil prevents foreign matter from falling into coil.

5. Cabinet of reinforced furniture steel—plus a reinforced air grille—adds to permanence and long-lasting beauty of unit.

6. Fans and motor on single mounting plate permit easy removal if necessary.

7. Ventilation can be adjusted with the fresh air damper located in each unit.

8. Spacious end compartments provide easy installation and allow more than 90° horizontal wrench swing.



AMERICAN-Standard
HEATING-COOLING

Serving home and industry

AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS • DETROIT LUBRICATOR • KEWANEE BOILERS • ROSS HEATER • TONAWANDA IRON

Here's the Big Difference!

TAPER-LOCK

–The Sheave that always runs true!

The Taper-Lock bushing seats evenly along the entire length of the hub. It is self-seating. There is no collar—no protruding part—no flange to prevent uniform compression.

With full contact, Taper-Lock sheaves run true. Made of finest grade of close-grained semi-steel, cast in the Dodge foundry. Precision grooves have identical pitch diameters so that every belt can pull its share of the load.

Sheave and bushing mount as a unit—easy to align on the shaft. Grips the shaft like a shrunk-on fit. Flush hub means safety.

THERE IS ONLY ONE TAPER-LOCK (a patented product of Dodge). Available from distributors' stocks in a complete range of sizes in A-B combination, B, C and D grooves. Also ask your distributors for Dodge Sealed-Life V-Belts. WRITE for complete data.

DODGE MANUFACTURING CORPORATION, 1600 Union St., Mishawaka, Indiana

DODGE

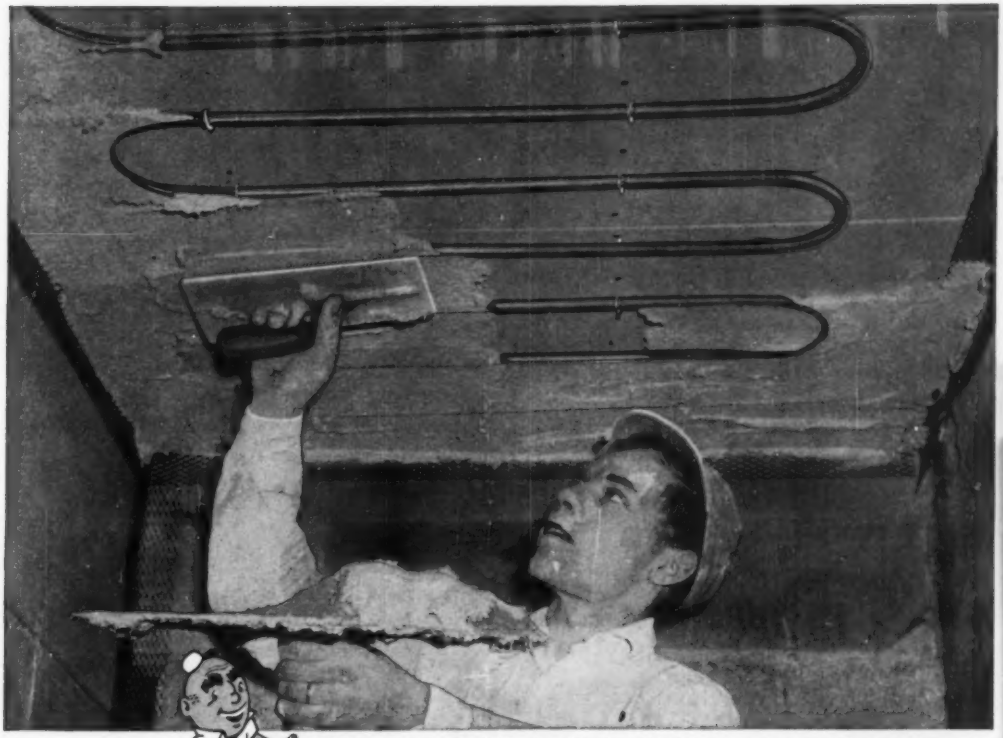
of Mishawaka, Ind.

CALL THE TRANSMISSIONEER

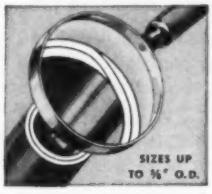
your local Dodge Distributor. Factory trained by Dodge, he can give you valuable assistance on new, cost-saving methods. Look for his name under "Power Transmission Machinery" in your classified phone book.

NAME PLATES

FOR YOUR NAME PLATE REQUIREMENTS, WRITE OUR SUBSIDIARY, CHICAGO THRIFT-ETCHING CORPORATION, 1355 SHEFFIELD AVENUE, CHICAGO 22, ILLINOIS



Extra-strong, lightweight coils of Bundyweld Tubing are easily mounted onto ceilings. Lying flat and straight, coils are quickly plastered over, with small chance of damage from rough handling or accidental hammer blows.



Key to Low Cost

Bundyweld is the only tubing double-walled from a single strip, copper-brazed through 360° of wall contact. It's leakproof, thinner walled, yet stronger. It transmits heat quickly, has high bursting strength. It saves on material costs and installation time.

Standard 20′ or 24′ lengths of Bundyweld are easily formed into coils in shop or on job site. Expanded ends (furnished when specified) are quickly soldered into leakproof union. Joined, lightweight coils are easily mounted onto ceiling, quickly plastered over.

Move out in front and stay there— with Bundyweld Ceiling Radiant Heating

Here's your chance to move out in front of competition and stay there—with Bundyweld Ceiling Radiant Heating.

The market's ready-made, fast-growing. And for good reason! Present users hail this clean, economical and convenient way to heat homes. They're sold on the idea of walls without dirt streaks, of warmth that's always even, of freedom from drafts, of lower fuel bills. And they're enthusiastically passing the word along to friends.

Thousands and thousands of prospective home owners are demanding more information. They're reading Bundy ads in *Better Homes & Gardens* and *American Home*. They're sending in a landslide of coupons requesting literature—and names of builders and plumbing and heating contractors handling Bundyweld Ceiling Radiant Heating. Many of these coupons come from prospects in your locality.

Send the coupon for further details. It may be the most important step you'll take in years.

Radiant Heating Division

BUNDY TUBING COMPANY

Detroit 14, Michigan

SEND FOR FREE LITERATURE!

LIKE HAVING THE SUN IN YOUR CEILING

Bundyweld Ceiling Radiant Heating

Radiant Heating Division, Dept. HP-1052
Bundy Tubing Company, Detroit 14, Mich.

☐ Send free 20-page nontechnical brochure explaining Bundyweld Ceiling Radiant Heating.

☐ Send Bundy technical radiant heating pamphlet.

Name _____ Title _____

Company _____

Address _____

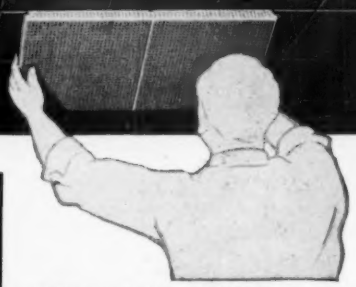
City _____ Zone _____ State _____

saves
installation dollars

solves
every important air distribution problem

for the *OWNER* • *ARCHITECT* *ENGINEER* • *CONTRACTOR*

- Complete concealment.
- Panel locations determined solely by load considerations.
- Relocation of partitions requires no panel alterations.
- Exceptional uniformity and control of room temperature.
- The highest loads and ventilating requirements handled with a total absence of strong air streams.
- System design, installation, and balancing extremely simple and rapid.



Material and labor saving installation features

1—Shop built duct work installed and system balancing completed prior to and independent of ceiling erection.

2—No additional material, structural work, turndown collars or rigid connections requiring close fitting, sealing or calking are involved.

3—All components of Modular Multi-Vent panels are quickly and easily assembled, attached and aligned in the ceiling by hand without the use of tools. No cutting or reshaping of standard ceiling materials is necessary.

4—Existing air distribution systems can be readily and economically converted to Modular Multi-Vent.

Write for bulletin 385 with complete details and specification data.

MULTI-VENT DIVISION

THE PYLE-NATIONAL COMPANY
1373 North Kostner Ave., Chicago 51, Ill.

NOW SHOWING
2 SMASH HITS BY UTILITY HEATING

MANY TOP FEATURES

Hurry hurry hurry—see the sensation of the forced air furnace field! Utility's 70FA Forced Air Furnace is breaking sales and popularity records all over the lot. That's because its 70,000 BTU input gives large home heating at small home cost. Yes, its performance is so high and its price is so low that home owners everywhere are buying Utility. Stock it today and watch your box office profits skyrocket! Super-quiet Dy-Rekt* drive blower assembly ... Sy-Lent* Heat Exchanger ... approved for zero clearance...easy to install, can be spotted in only 14" x 25½" floor space (in closets, alcoves, etc.) ... AGA approved.

*Pat. Pending

Second big hit is Utility's 50RD Recessed Dual Wall Heater. It pulls in the customers because it's amazingly low in price... does a double-feature heating job and delivers the air at living level where it really does some good. Prospects love its cool-to-touch Fiberglas insulated panel. And it has fully automatic controls... fits between standard 16" center studs... 50,000 BTU input. Utility's 50RD Recessed Dual Wall Heater is 60" high, and the front panel is 17" wide... and the unit is as handsome as a matinee idol! Stock Utility's 50RD now ... you'll have a real crowd-pleaser on your Utility Heating Equipment show!

YOU'LL HAVE A BETTER BOX-OFFICE TAKE THE YEAR 'ROUND WITH UTILITY HEATING AND COOLING EQUIPMENT

UTILITY TRADE MARK — Guaranteed Heating Performance

The Complete Line of Automatic Gas Heating Equipment

UTILITY APPLIANCE CORP.

4851 S. Alameda Street Los Angeles 58, California

Manufacturers of Air Coolers, Blowers, Gaffers & Sattler and Occidental Automatic Gas Ranges

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Please send me information about how I can build bigger year 'round business with Utility Heating and Cooling Equipment.

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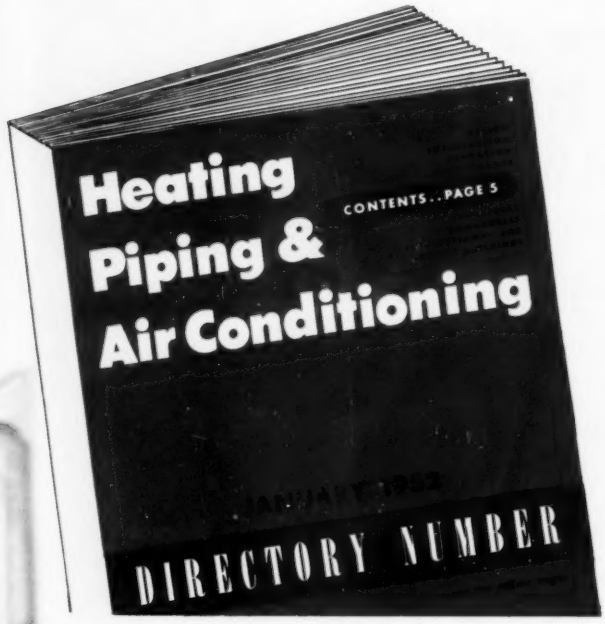


- PRODUCTS CLASSIFIED
- TRADE NAMES
- MANUFACTURERS' ADDRESSES

HERE IS YOUR SOURCE

of Complete Product Information

. . . Are You Finding It Useful?

If you are like the average subscriber,* you have near at hand—and frequently use—the January 1952 Directory Number of HP&AC . . . . the field's complete reference guide to the products which engineers and contractors specify and purchase for the heating, piping and air conditioning work they handle.

Each January you get a new, up-to-date HP&AC Directory Edition. It's a part of your annual subscription to our publication.

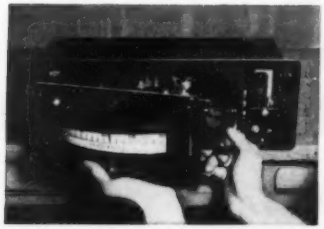
Soon we will be starting to compile the January 1953 Directory Number.

Have you any suggestions for making the 1953 edition *more* valuable? . . . . suggestions which we as publishers might adopt, or which we can pass along to the many manufacturers who co-operate with us by furnishing complete data on their products in each January Edition?

Your comments are sincerely welcomed.

* **Over 90% of those HP&AC subscribers, answering a recent survey, stated that they find the current (1952) Directory Edition helpful in their work.**

FIRST *in Editorial . . . in Circulation . . . in Advertising*



G-E Pyrometer Equipment Quick and Easy to Inspect, Maintain

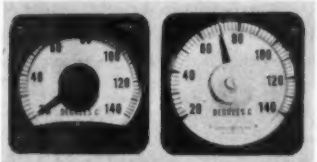
Routine inspections of new General Electric Type HP pyrometers can quickly be made. Besides making preventative maintenance easy, this equipment has many other features to provide accurate indication and temperature control of furnaces, ovens kilns, and other industrial heating equipment.

ACCURATE WITHIN ¾ OF 1% full scale, HP-3 pyrometers have automatic cold-junction compensation that adjusts for changes in ambient temperature.

Any change in temperature, even as small as 0.1% full scale, starts immediate control action. Normal changes in humidity, ambient, and voltage have little or no effect on the exactness of control action.

FOUR TYPES AVAILABLE—indicating, protecting, two- and three-position control forms; also both flush and surface mountings. All available in a variety of temperature ranges in the 0-3000 F span.

Mail the coupon for complete information about Type HP pyrometers.



New Shadow-proof Temperature Indicators Are Easier to Read

Temperatures from −100 F to +300 F can now be accurately indicated and controlled with General Electric's new line of temperature indicators. These instruments can be read from almost any angle. The dial is set forward, flush with the front of the case. A protruding convex-type glass front provides clear illumination. No more cover overhang; no more shadows caused by overhead lighting. Two sizes available—4¼- and 8¾-inches. Check coupon.

New Resistance Thermometers Accurately Indicate and Control Low Temperatures

TEMPERATURES FROM −100F to +300 F can now be accurately indicated and controlled with General Electric's new line of resistance thermometers. They indicate accurately within ¾ of 1 per cent full scale. Any change in temperature equivalent to 1/10 of 1 per cent full scale starts immediate control action.

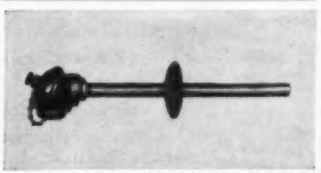
Normal changes in humidity or room temperature do not affect the exactness of control. Neither does a change in control voltage. Sturdy, simple construction assures reliable operation under severe operating conditions.

NARROW TEMPERATURE SPANS, as small as 90 degrees, are available anywhere in the −100 F to +300 F range. You can buy four types of resistance thermometers—indicators, protectors, and two- or three-position controllers—for either flush or surface mounting.

For complete information, mail the coupon below.

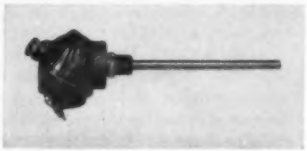
THERMOCOUPLE POTENTIOMETER measures temperature in locations inaccessible to glass-stem thermometers. Any number of different readings can be taken in rapid succession and accurate within ±0.2% of full scale.

Typical applications include refrigerator-development work, oil-burner and air-conditioning tests, steam temperature measurements, and heat-run tests on electric equipment. For complete information, mail the coupon below.



THERMOCOUPLES, COMPONENTS, AND ACCESSORIES for your pyrometer installations include protecting tubes and wells, thermocouple wire, ceramic insulators, extension wire, connectors, heads, selector switches. Send coupon today for catalog to help you obtain proper thermocouple assemblies.

Resistance Bulbs Accurate Within ±1 F between −100 F and +300 F



FOR ANY RESISTANCE THERMOMETER INSTALLATION, new G-E resistance bulbs offer a high degree of accuracy and reliability. They're available either with completely enclosed terminal head or without terminal head and with four feet of flexible cable. Units will retain calibration within 0.1 F. For complete information, mail the coupon below.

SECTION U 602-227, GENERAL ELECTRIC
SCHENECTADY 5, N. Y.

Please send me the following bulletins:
Indicate:

- √ for reference only
- x for planning an immediate project
- ☐ Resistance Thermometer (GEC-835)
- ☐ Resistance Bulb (GEC-835)
- ☐ Type HP-3 Pyrometer (GEC-713)
- ☐ Temperature Indicators (GEC-218B)
- ☐ Thermocouples, Accessories (GEC-714)
- ☐ Thermocouple Potentiometer (GEC-245)

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GENERAL ELECTRIC

"WE SAVE $9,000 A YEAR—AND HEAT MORE SPACE—BY BURNING COAL THE MODERN WAY!

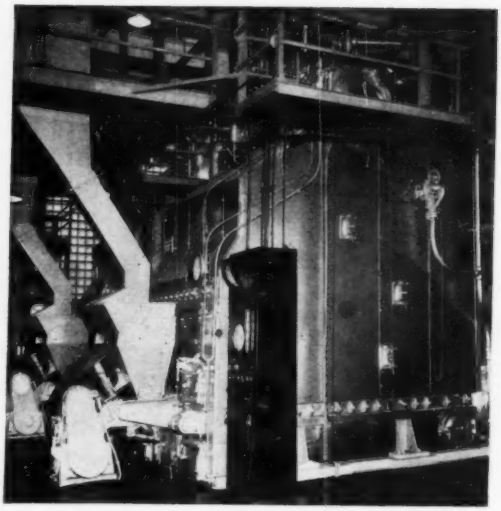
NEW COAL INSTALLATION SAVES US 31.9%—43¢—ON EVERY THOUSAND POUNDS OF STEAM!"

says Mr. Robert W. Paul, Heating Engineer, the University of Akron, Akron, Ohio.

NO SMOKE CONDITION... NO DUST NUISANCE—

this plant is located in a residential neighborhood and operates well within the bounds of extremely tight smoke and dust regulations—thanks to burning and handling coal with up-to-date equipment!

This view shows Akron's two new stoker-fired boilers. The old equipment delivered a thousand pounds of steam at a cost of $1.35. Now Akron gets a thousand pounds of steam for only 92 cents, *cutting cost by nearly* ⅓! For about $26,000 a year, this new plant does the work that would have cost $35,000 with the old one.



If you operate a steam plant, you can't afford to ignore these facts!

COAL in most places is today's lowest-cost fuel.

COAL resources in America are adequate for all needs—for hundreds of years to come.

COAL production in the U.S.A. is highly mechanized and by far the most efficient in the world.

COAL prices will therefore remain the most stable of all fuels.

COAL is the safest fuel to store and use.

COAL is the fuel that industry counts on more and more—for with modern combustion and handling equipment, the inherent advantages of well-prepared coal net even bigger savings.

BITUMINOUS COAL INSTITUTE

A Department of National Coal Association, Washington, D. C.

Planning to modernize? Building a new plant? In either case an up-to-date coal installation can save you lots of money!

Labor costs are cut to a minimum with modern coal- and ash-handling systems . . . modern combustion equipment gives more steam per dollar—10 to 40% more power from every ton of coal!

A consulting engineer can show you how these savings really mount up—and mount up fast—when you burn *bituminous* coal in a modern plant designed to meet your *specific* needs.

And coal's your best bet for the future, too. Of all fuels, coal alone has virtually unlimited reserves. And America's coal is mined by the most productive and efficient coal industry in the world. That's why coal offers greater price stability and more dependable supply than any other fuel!

FOR HIGH EFFICIENCY *FOR LOW COST*

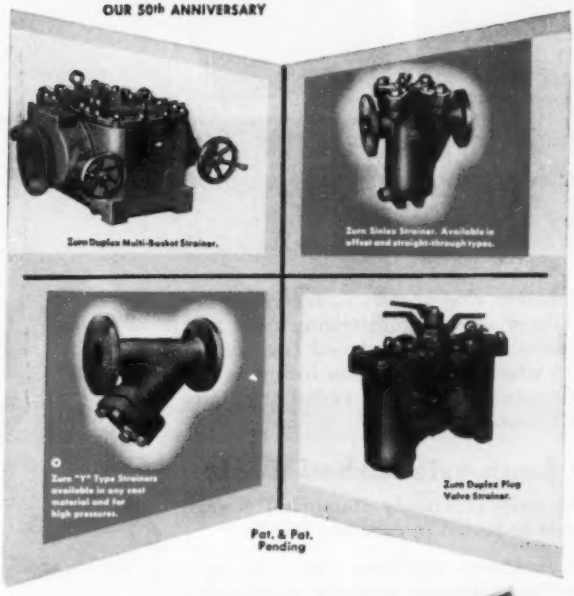
YOU CAN COUNT ON COAL!

ENGINEERED

To Permit High Rates of Flow With Remarkably Low Pressure Drop

ZURN LOW PRESSURE DROP STRAINERS

OUR 50th ANNIVERSARY


Zurn Duplex Multi-Basket Strainer.
Zurn Simplex Strainer. Available in offset and straight-through types.
Zurn "Y" Type Strainers available in any cast material and for high pressures.
Zurn Duplex Plug Valve Strainer.
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IMMEASURABLY IMPROVE THE HANDLING OF FLUIDS (OIL, CHEMICALS, WATER) THROUGH PIPE LINES

Now, a reduction of pressure loss can be obtained by the installation of Zurn Engineered Strainers. Design improved for correct circularity, smooth inner walls combined with correctly sized and perforated baskets reduce pressure loss and afford maximum protection for all types of mechanical units connected with pipe lines.

Zurn Strainers, are held to close manufacturing tolerances for materials, shape, and dimensions assuring the utmost in strength and safety. Zurn Strainer applications include fluid handling lines for lubricating and fuel oil, and oil during the refining process; a wide range of chemicals produced and used by the various process industries; public utility power plants; power stations; industrial plants; municipal water systems; ships and high temperature, high pressure installations. Zurn Fluid Handling Engineers are available for consultation on your fluid handling problems.

Write for Pipe Line Strainer Manual No. 951, including previously unpublished pressure drop data.

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INDUSTRIAL DIVISION • ERIE, PA., U. S. A.
In Canada: Canadian Zurn Engineering Ltd., Montreal, P. Q.

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Industrial Division; Erie, Pa., U. S. A.
Please send me Pipe Line Strainer Manual No. 951

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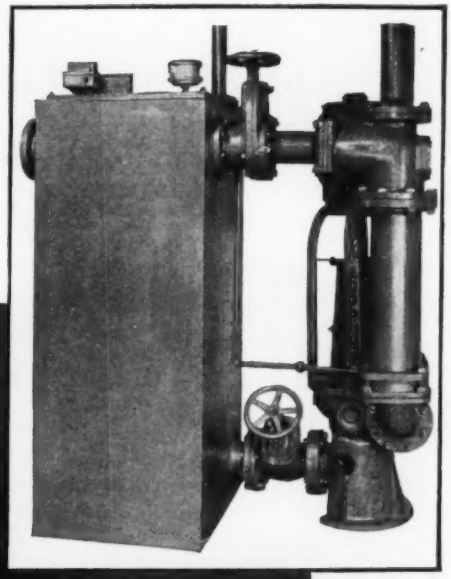

There's no substitute for
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FLUSH-KLEEN

Sewage Ejector of Proved Performance

"Flush-Kleens" are positively clog-proof . . . the impellers handle nothing but strained sewage, minimizing wear and maintaining pump balance. Specially designed for plumbing systems in buildings where the maximum inflow is not more than 50 GPM. A second unit can be added any time, to make a duplex installation.

Look at These Long-established Facts

- "Flush-Kleens" are the only absolutely clog-proof sewage pumps; impellers are not required to pass any solids.
- The "Flush-Kleen" will pump anything that will pass through the pipe regardless of type or quantity of material.
- "Flush-Kleen" needs no manual attention other than lubrication and inspection. No labor is needed to dis-assemble and clean.
- "Flush-Kleen" selection is not limited to a narrow pumping range. The impeller maintains dynamic balance over a wide range, preventing strain on shaft and bearing.

Write for further information and test data on Chicago Pump Company "Flush-Kleen" Sewage Ejectors.

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BUILDING and INDUSTRIAL DIVISION

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efficiently designed for sidewall and baseboard installations

The Standforated sidewall registers have horizontal bendable bars, set at time of fabrication for 30 degree downward deflection. Each bar can be easily readjusted with a tool to any angle for upward, downward or straight flow. **No. 41H SIDEWALL REGISTER** has a single damper and 3/16" turned down edge for flush sidewall installation. Sponge rubber gaskets are attached. **No. 43H BASEBOARD REGISTER** has a single damper and 7/8" projection top and two ends, for baseboard installation. Also available as: **No. 42H BASEBOARD INTAKE** and **NO. 40H SIDEWALL GRILLE**. Prime coat or metallic finish—standard screw holes. Over-all of face is listed duct dimension plus 1 3/16".

DUCT SIZE
8" x 4"
8" x 5"
*8" x 6"
10" x 4"
10" x 5"
*10" x 6"
10" x 8"
12" x 4"
12" x 5"
*12" x 6"
12" x 8"
14" x 4"
14" x 5"
*14" x 6"
14" x 8"
24" x 4"
24" x 5"
24" x 6"
24" x 8"
30" x 4"
30" x 5"
30" x 6"
30" x 8"

*Stock Items

Registers are visible symbols of comfort. On your jobs, you want the best to show . . . so, to be *sure*, use Standard Stamping's Registers and Grilles. All Standard registers are engineered for accurate and easy operation. Illustrated above is model No. 41H Sidewall Register. The side view shows* one of the *two damper tension screws* that are adjustable to meet your operational requirements. The tension screws are set at the factory for positive operation. On the damper control lever is Standard's new **FRACTIONATOR VOLUME CONTROL.** This amazing new device allows you to set the damper for optimum volume in balancing your heating system, and maintain that balance permanently.

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"327" UNIT HEATER

Sets NEW standards in . . .

Quiet Operation . . . NO narrow passages to cause whistling . . . it's open, streamlined—efficiently designed to HUSH the air flowing through.

Compactness . . . the "327" installs within inches of ceiling, saving space. It's lighter, easier to handle, easier to install.

Comfort . . . no cold blasts at start of cycle. Fan won't start until the heat exchanger is warm enough to assure comforting heat.

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Extra-Sensitive Controls . . . responsive low-voltage controls mean better, more uniform heat. Safety controls prevent overheating.

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A Program for 30 million new Americans

LISTEN to the voices of 30 million new Americans. They are answering the pessimists who say we are threatened with depression because we can't keep our farms and factories busy.

Let these pessimists read the future in the census returns. There is a tremendous upsurge in our population. Last year nearly 4 million babies were born. By 1960 we shall total 170 million people--30 million more than when war ended in 1945. This adds to our domestic market more people than there are in Canada and Australia combined.

Providing for these 30 million new Americans can keep our production machinery going at capacity. They call for new hospitals, schools and churches. Larger families need bigger houses to replace postwar houses that are too small now. More and bigger families need improved home equipment and more new automobiles. In short, to maintain and improve living standards for our children, we must work harder than ever before. To supply the needs of our 1960 population, including adequate national defense, it is estimated that the productivity of the individual worker must increase at least 30%, with additional investment of over 200 billion dollars in capital facilities.

There should be no room in this picture for depression. But we must have economy in government, elimination of waste and extravagance and a reduction of taxes and public debt. If we encourage private incentive, thrift and investment, we can bring about the greatest advance in health, wealth and happiness that America has ever known.

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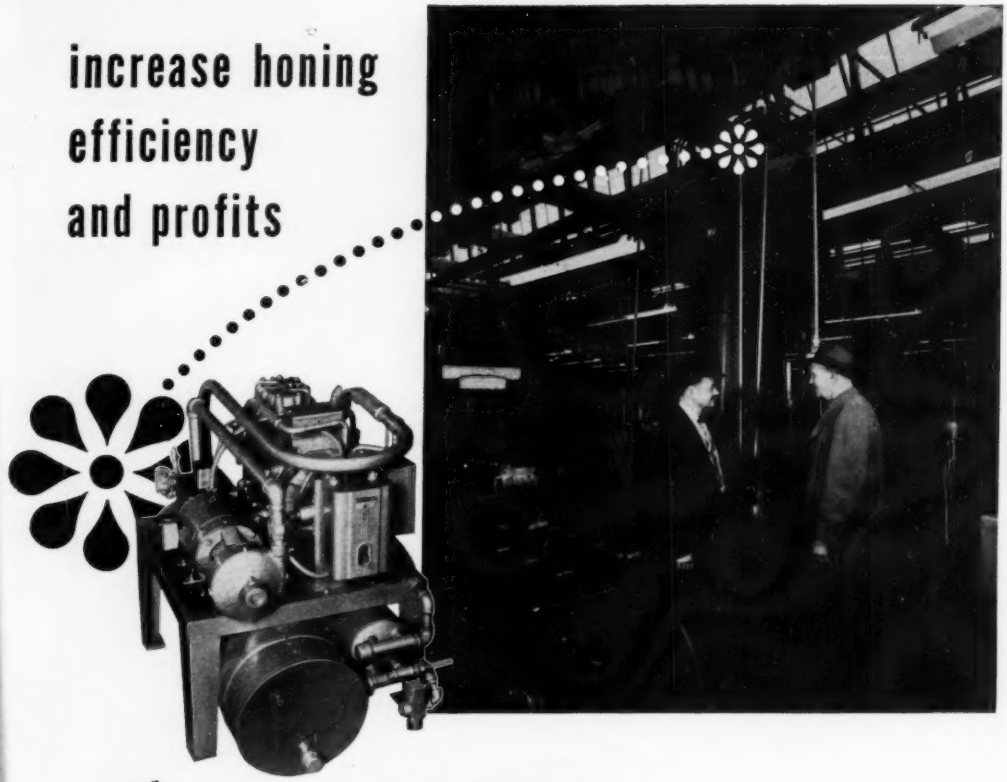
increase honing efficiency and profits



with Acme FLOW-COLD® Packaged Liquid Chiller

PROBLEM

THE REO MOTOR COMPANY in Lansing, Michigan had two honing machines that were not operating at peak efficiency because the oil used in the coolant process picked up large amounts of heat during the honing operation. The result was low production and a large number of rejects. Extremely limited space made the installation of the usual industrial chilling unit impossible.

PLAN

Acme engineers recommended the installation of a 15-horsepower Flow-Cold Liquid Chiller. This unit with a cooling capacity of 40 gallons per minute in reducing the coolant used from 90 to 70 degrees, met minimum space requirements. Mounting the pump of the chiller on the floor and the liquid chiller overhead allowed the pumps of the honing machine to remain in the same position where they could continue to service the machine when the chilling unit was shut down.

PROFITS

An immediate increase in production capacity and a decrease in the number of rejects was evidenced as the heat was dissipated during the chilling process and the coolant returned to the honing machines at a constant temperature. The compact packaged Flow-Cold serviced the two honing machines with maximum efficiency and performance.

Since this installation was made Reo has added two more Flow-Cold "packaged" units — one for a broaching machine and the other for a quench-bath cooling process.

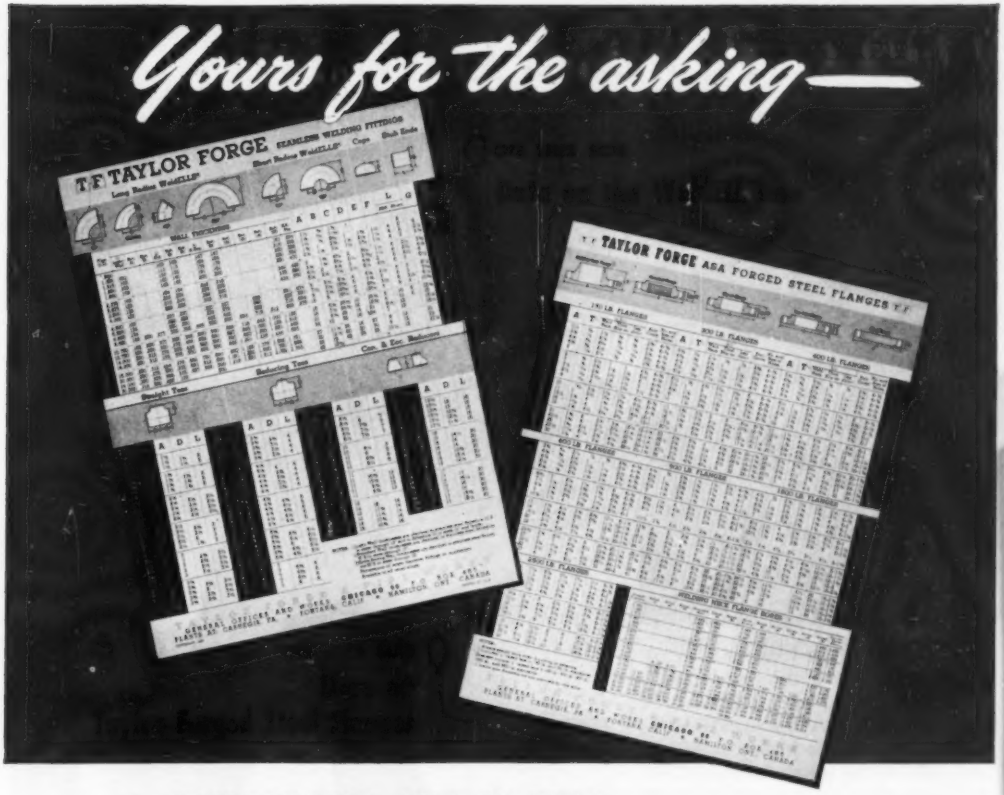
ACME PRODUCTS

ACME INDUSTRIES, INC., JACKSON, MICHIGAN, U.S.A.

Flow Cold Division

CONTINUOUSLY SERVING THE AIR CONDITIONING AND REFRIGERATION INDUSTRIES SINCE 1919

Yours for the asking—



A VOLUME OF DATA

. . . covering welding fittings and forged steel flanges . . .

ON A SINGLE SHEET

Here is just about the handiest tool ever devised for the pipe designer. Data on welding fittings and flanges that otherwise could be found only by plowing through many catalog pages and tables have been ingeniously condensed on the two sides of the durable letter-size card illustrated above.

One side covers the broad WeldELL line of Taylor Forge welding fittings. For every nominal pipe size, ½" through 30", it shows the wall thickness for every weight of every fitting in every available material. It also shows all required dimensions of all types of fittings.

The other side covers the world's most complete line of forged steel flanges. For every nominal pipe size, ½" through 24", it gives all essential dimensional and bolting data for all types of flanges in all weights. A particularly useful table (see reproduction) is that showing welding neck flange bores which enables you to determine the I.D. of any nominal pipe size without separate calculation. Thus the sheet gives you O.D. and I.D. of any weight of pipe.

The card is varnished to make it stand the steady usage you are certain to give it. To obtain your copy see your Taylor Forge distributor or **MAIL THE COUPON.**

T-F

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"C" CHARGE *for* SUCTION TEMPERATURES ABOVE ZERO

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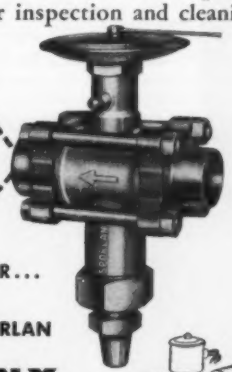

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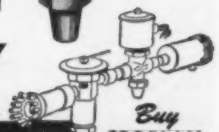

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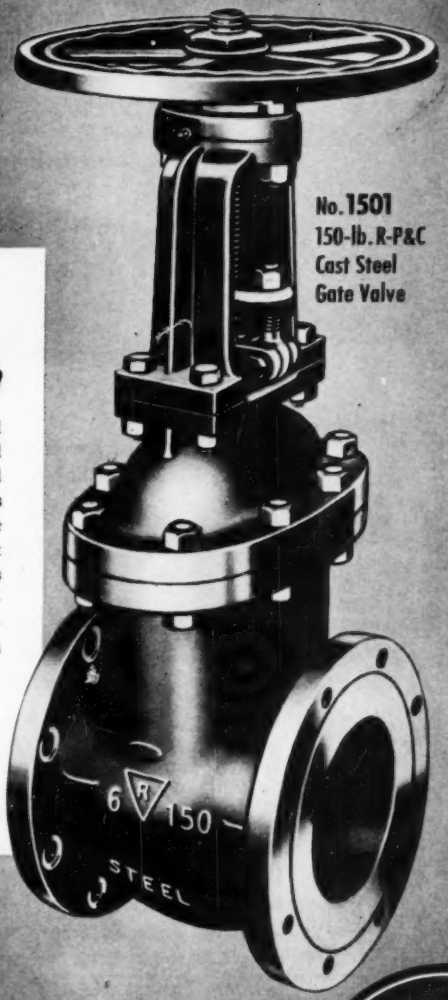

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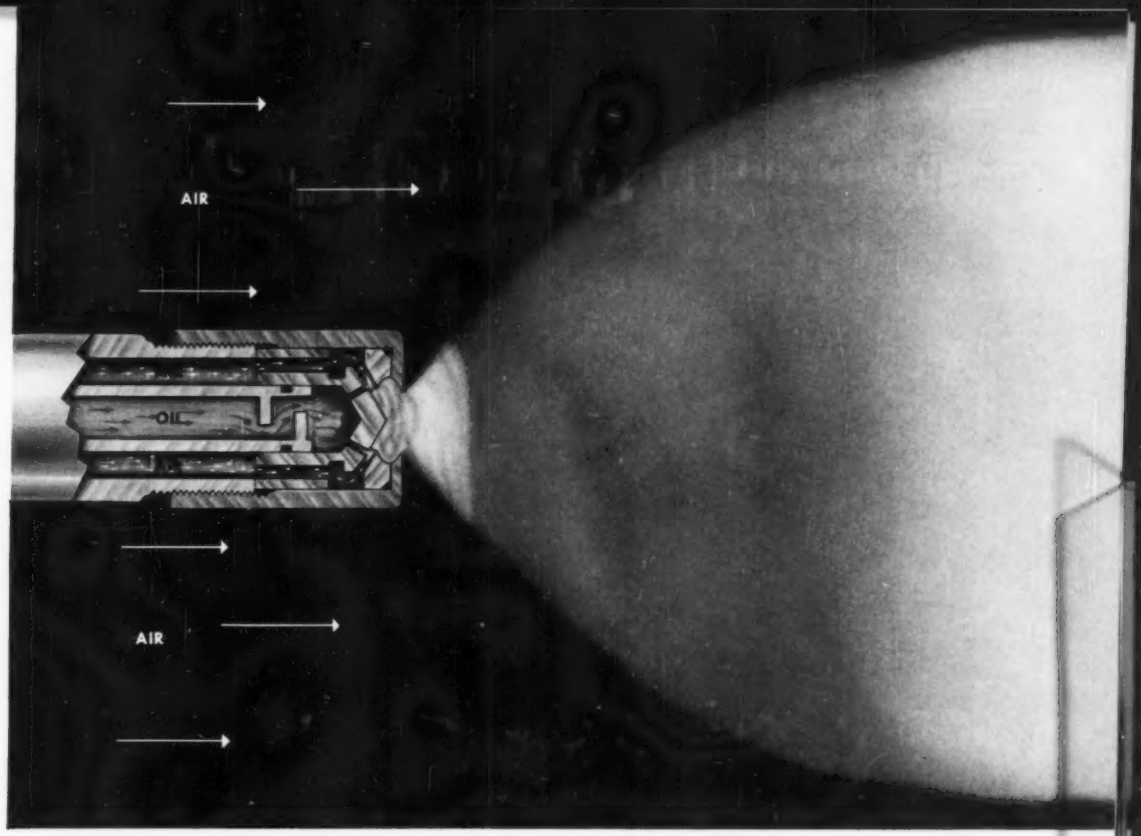

NOW—only Powermaster gives you VORIFLOW combustion!

LATEST DEVELOPMENT IN BURNER DESIGN REDUCES COSTS AND INCREASES BOILER EFFICIENCY

Here's what *Powermaster's* new VORIFLOW burner will do for you:

1. Saves fuel by providing infinitely variable combustion modulation in response to demand—with *full efficiency*—through wide range from 30% to 100% of firing capacity.

This means elimination of waste and maintenance headaches because of incomplete combustion. With the exclusive design of the VORIFLOW burner, tiny jets of compressed air pulverize every droplet of oil . . . projecting a fine fog of oil/air emulsion into the combustion area where it ignites and burns —immediately and completely. The VORIFLOW burner does away with outmoded mechanical spinning devices, globules of wasted oil, and gummy cleaning problems.

2. Slashes boiler maintenance costs.

There are *no* moving parts to wear out • There is *no* cup to clean daily. Routine cleaning of the burner once a month is sufficient • There is *no* burner vibration to throw adjustments "out of whack" • Parts are made of stainless steel, brass, and beryllium copper—they will last indefinitely.

3. The combination burner permits rapid change-over from one fuel to another—light oil, heavy oil, or gas.

And when we say "rapid" we mean just that—the job can be done in four minutes. Modulating firing controls are ready to go into action at the flick of a switch. It isn't necessary to change the entire burner assembly. All you need to do to fire gas is to remove the oil nozzle.

Before deciding on a boiler for your plant, be sure to get the facts on the newest POWERMASTER with VORIFLOW combustion. Write for this catalog that gives you the entire story of the *Powermaster* packaged automatic boiler. Just drop us a line and we'll put one in the mail for you.

YOUR CUSTOMERS and PROSPECTS are reading this message. It tells why the Powermaster gives outstanding performance. We'll be glad to send you more information.

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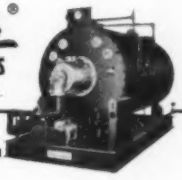
PACKAGED AUTOMATIC BOILERS

In sizes to 500 HP; pressures to 250 psi.



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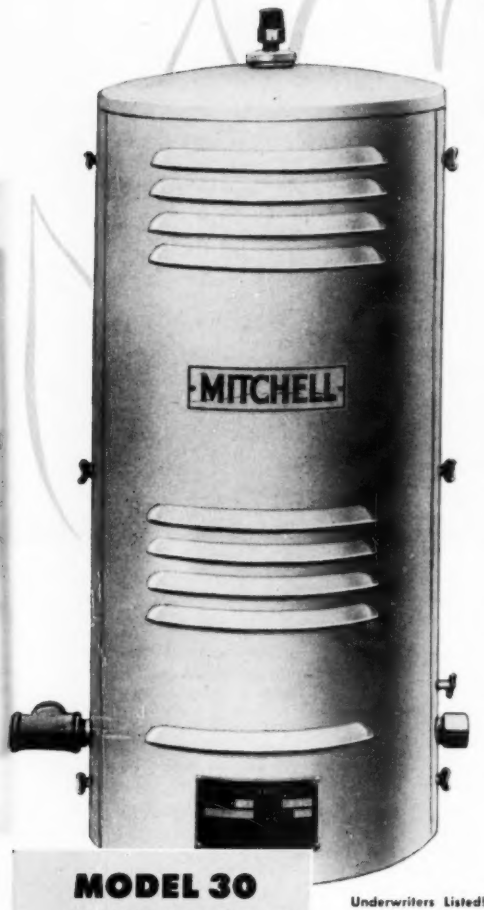


MODEL 30

MITCHELL Vaporizer

Capacity—30 gallons per hour (rated input—30,000 BTU per hour). Other models from 2 to 280 gallons per hour.

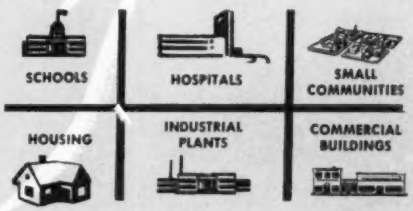
Underwriters Listed!

PREVENTS FREEZE-UPS DUE TO TEMPORARY OVERLOADS OR LARGE WITHDRAWALS

When you are designing systems for butane-propane, think of MITCHELL Vaporizers for constant gas supply in precise response to demand.

By patented Automatic Selective Control, a MITCHELL Vaporizer safely provides reliable butane-propane gas supply without danger of freeze-ups due to temporary overloads or large withdrawals.

Get the facts on MITCHELL Vaporizers . . . let our Engineering Department supply you with complete information for any specific installation on which you are working.



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Tells how the MITCHELL Vaporizer is installed . . . how it's used . . . address JOHN E. MITCHELL COMPANY, 3800 Commerce St., DALLAS, TEXAS.

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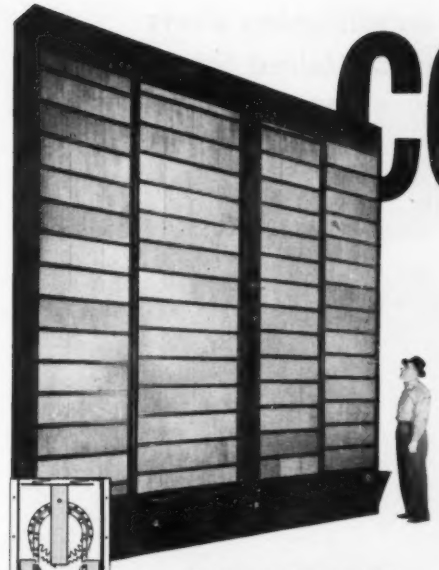
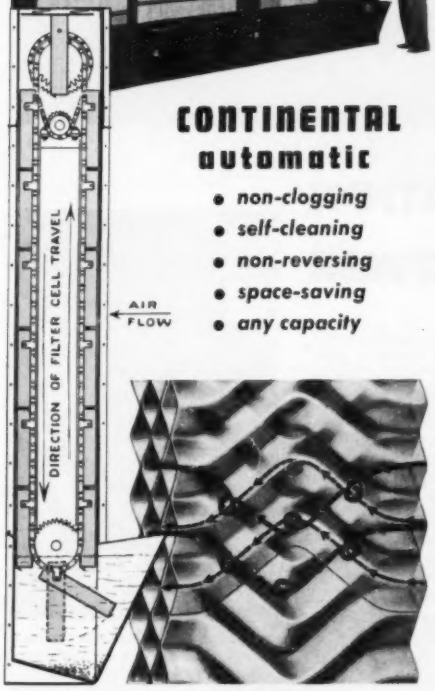
any other automatic, self-cleaning air filter, with CONTINENTAL!

You will then be convinced that Continental Automatic, Self-Cleaning Air Filters are unexcelled in engineering and construction. You will then fully appreciate Continental's three exclusive advantages! So . . compare . . and learn why Continental provides unequalled air-filtering performance.





CONTINENTAL automatic

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Compare Air Flow

In Continental Air Filters, the filter cells move up and across top of filter. Cells are free to rotate around an axis like the cars on a ferris wheel (see cutaway drawing). As cells, holding their vertical position, pass from front to back curtain, *there is no reversal of air flow* through the filter media. Result: in Continentals, dirt is *never* blown back into the clean-air stream.

Compare Self-Cleaning Action

As each cell, in Continental Air Filters, moves down into the cleaning oil, it is stopped and held in a semi-horizontal position (see cutaway drawing) until the accumulated dust is *soaked loose*. The cell then drops quickly into a vertical position. This action causes a surge of oil to pass through the filter media, *counter-air flow*. Result: In Continentals, a thoroughly self-cleaned filter.

Compare Air Filter Media

The Continental Air Filter media has honeycomb openings with large, non-clogging air passages (see sectional drawing). Result: Low resistance and unequalled efficiency in over-all performance.

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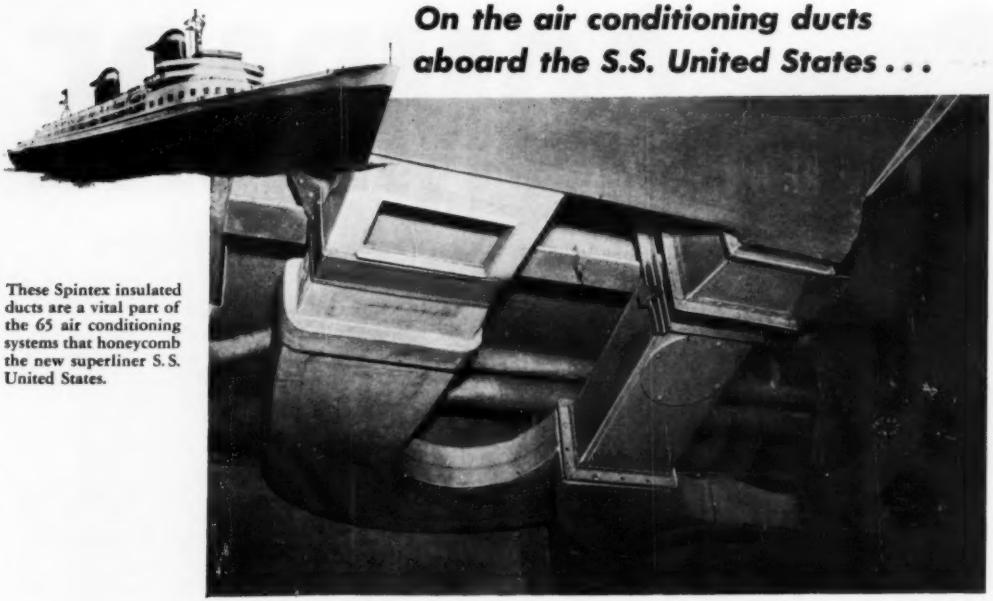
CITY_____ STATE_____

On the air conditioning ducts aboard the S.S. United States . . .



These Spintex insulated ducts are a vital part of the 65 air conditioning systems that honeycomb the new superliner S. S. United States.

NEW J-M *Spintex* INSULATION CONSERVES FUEL AND POWER

MILES OF DUCTS . . . a vital part of the 65 air conditioning systems that honeycomb the S. S. United States . . . are insulated with Johns-Manville Spintex. This insulation was selected because it makes possible maximum passenger comfort at minimum operating cost.

Low thermal conductivity . . . plus resistance to moisture, fire, rot and mold growth . . . make Spintex the most effective insulation for guarding against heat transfer and moisture accumulation.

Spintex in flexible and semi-rigid types, plus rigid Rock Cork* and Zerolite*, form a team of Johns-Manville insulations for air conditioning ducts that meet every industrial requirement. Basically mineral products, each insulation has its particular characteristics that make it specially suitable for a specific air conditioning service. All three have the low heat transfer properties needed for high insulating efficiency. Properly installed, these insulations for air conditioning ducts will perform their function effectively for the entire life of the equipment on which they are applied.

Since proper application is so essential to the peak performance of any insulation, Johns-Manville offers industry the services of experienced installation contractors who have made a career of solving complex insulation problems.

J-M Insulation Engineers and J-M Insulation Contractors are conveniently located. They stand ready to combine their talents and give you an insulation job that will pay off your initial investment with maximum fuel savings.

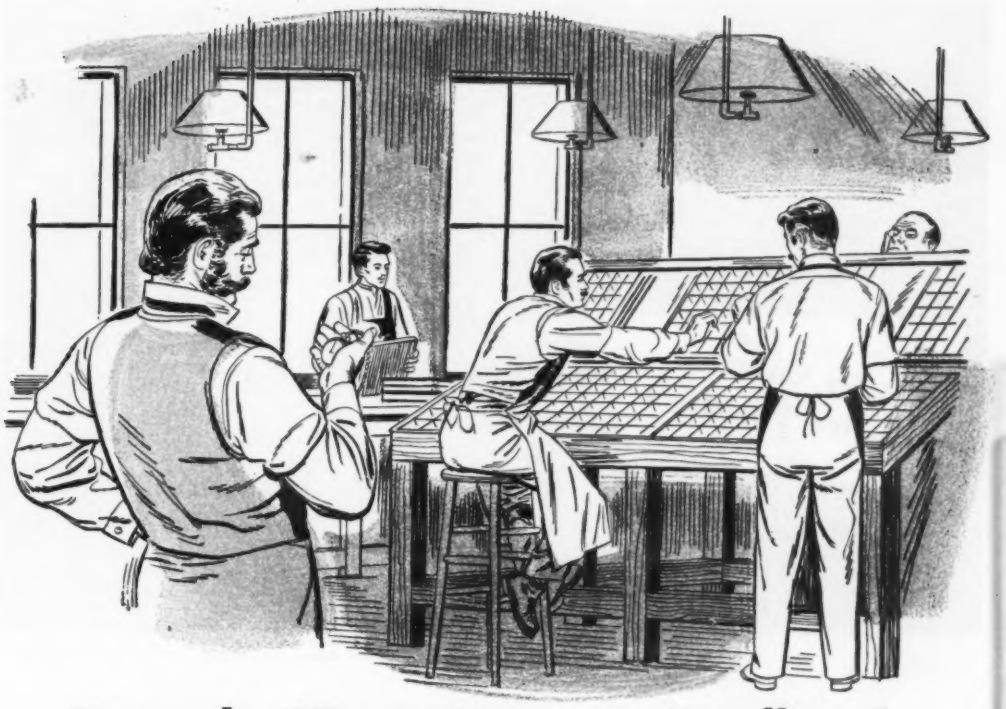
Why not let us send you a free copy of Brochure IN-135A which gives all the facts about Johns-Manville Insulations for Air Conditioning Ducts? Write Johns-Manville, Box 60, New York 16, N. Y. In Canada, 199 Bay Street, Toronto 1, Ontario.

*Reg. U. S. Pat. Off.

Applying Johns-Manville Spintex insulation on one of the ducts aboard the S. S. United States during construction at the Newport News Shipbuilding and Dry Dock Company. Johns-Manville Insulation Contractors throughout the country know Spintex and other J-M insulations as *quality* products, and take pride in applying them properly for peak performance.

Johns-Manville *FIRST IN* INSULATION

MATERIALS • ENGINEERING • APPLICATION



Up-to-the-Minute News *vs. Deadlines!*

Now, pages of type are set mechanically, in the time formerly required for just a few hand-set paragraphs. Thanks to the invention of power-driven typesetting equipment, and its ready adoption, your modern newspaper meets edition deadlines with ease and with all up-to-the-minute news.

In all walks of life electric motor power has lightened the burden of toil and made working hours more productive. Emerson-Electric experience, dating back to 1890, covers this entire era of mechanization progress. Emerson-Electric Motors bring to your product the benefits of this valuable experience plus an enviable reputation for dependability and efficiency.

Consult with us, without obligation, about motors for your regular or new products. Standard Motors are made in horsepower ratings 1/20 to 5 H.P., and Hermetic Motor parts 1/8 to 15 H.P. *Write...*

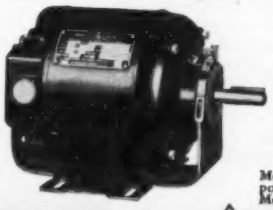
THE EMERSON ELECTRIC MFG. CO., St. Louis 21, Mo.

MODERN BUSINESS IS POWERED WITH ELECTRIC MOTORS

Write for these Emerson-Electric Motor Data Bulletins

Manufacturers requiring motors 1/20 to 5 h.p. can profitably use these *reference* guides. Specifications, construction and performance data are included for these motors:

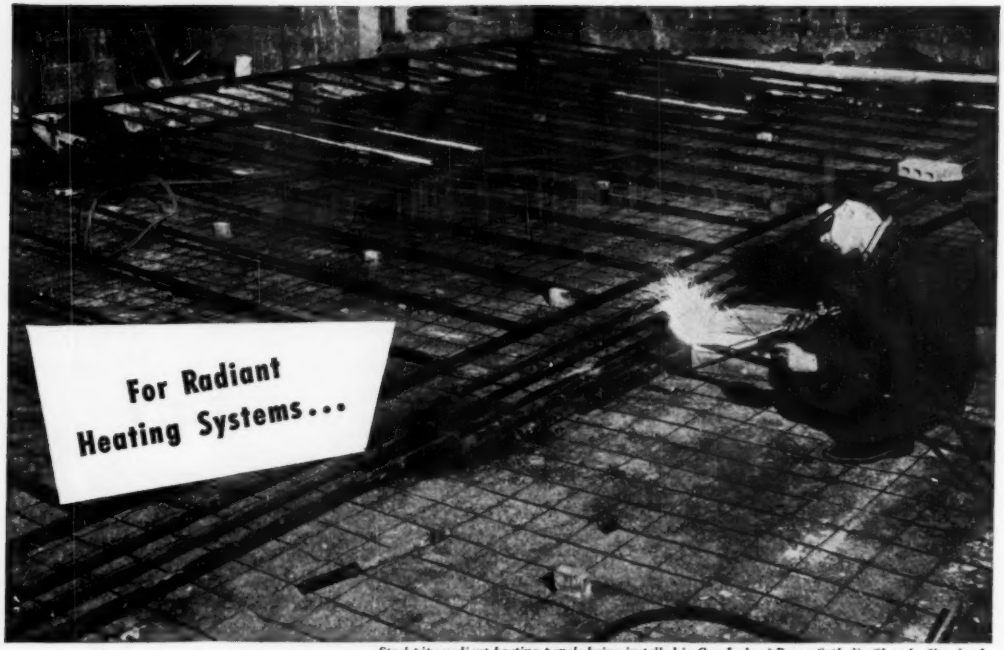
- ☐ M154-A Capacitor-Start
- ☐ M154-B Split-Phase
- ☐ M154-C Integral
- ☐ M154-D Fan-Duty
- ☐ M-154E Oil-Burner
- ☐ M-154F Jet Pump
- ☐ M-154G Blower



Mergenthaler Linotypes have been powered with Emerson-Electric Motors since 1901.

EMERSON ELECTRIC
MOTORS • FANS APPLIANCES

LEADERS IN THE MOTOR AND FAN INDUSTRY SINCE 1890



Steel pipe radiant heating panels being installed in Our Lady of Peace Catholic Church, Cleveland, Ohio, by Sweeney & Wise Co., Cleveland. Heating engineer is George F. Evans, Cleveland, Ohio.

REPUBLIC Steel Pipe

Goes in FAST... Goes in to STAY

● Here's the new big volume field for heating contractors. It's large-building heating with radiant panels fabricated of durable, economical Republic Steel Pipe.

Steel pipe radiant heating systems are especially suited to the cold-weather needs of churches, auditoriums, arenas, garages, public and industrial buildings, other large-area structures. Equally suited to home heating needs. Good for snow-removal systems, too.

As you know, *steel* pipe has been the standard for closed hot-water circulating systems for many years. It has done that job well, giving long, trouble-free service. And, today's Republic Steel Pipe—made under Republic's *own* advanced continuous weld process—is even better than that which has served so well in the past.

You'll find Republic Steel Pipe highly ductile and easy to fabricate . . . just right for the close coiling and bending which radiant panels require. It threads cleanly, and welds readily to tight leak-proof joints.

It's a good idea to check with your Republic Pipe Jobber as soon as you can about pipe for the radiant heating jobs you've got scheduled. He'll be glad to give you latest information about available sizes and current deliveries.

REPUBLIC STEEL CORPORATION
GENERAL OFFICES • CLEVELAND 1, OHIO
Export Department: Chrysler Building, New York 17, N.Y.

REPUBLIC CONTINUOUS WELD PIPE

Easy to bend, thread and close coil
Easy to weld by all methods
Uniformly ductile
Uniformly strong
Uniformly clean and scale-free
Uniform wall thickness, diameter, concentricity
Economical uniform lengths, extra long lengths
Expansion co-efficient same as concrete and plaster

RIGHT SIZE . . . WRONG GASKET . . .

A gasket may fit but still not give the proper seal. It may be too *soft* and crush under the applied load. It may be too *hard* and resist the compression necessary for an effective seal, resulting in bolt fatigue. Two sealing problems—one calling for a gasket to support 3285 psi, the other for 13,500 psi—call for two Flexitallic Gaskets of different densities though the gasket dimensions may be the same . . . Each Flexitallic Gasket is engineered to meet specific conditions of thermal and physical shock, corrosion, vibration, weaving and unpredictable joint stresses. Spirally wound V-crimped plies of required metal with alternating plies of proper filler results in a resilient gasket having characteristics of a calibrated spring. Flexitallic Gaskets are at highest efficiency when bolted up cold at a pre-determined load. For all pressure/temperature ranges from vacuum to 4000 lbs., from extreme sub-zero to 2000° F. For all standard joint assemblies. In four thicknesses for special requirements: .125", .175", .250", .285". With Teflon filler for corrosive chemical conditions. Write us your requirements . . . Flexitallic Gasket Company, Eighth and Bailey Streets, Camden 2, New Jersey. Representatives in principal cities. Consult your Classified Telephone Directory.

Flexitallic®
SPIRAL-WOUND GASKETS

FOR PIPE FLANGES, PRESSURE VESSELS AND PROCESS EQUIPMENT

*Not all spiral-wound gaskets are Flexitallic. Look for the name FLEXITALLIC stamped into the metal spiral of every genuine Flexitallic Gasket. Look for *Flexitallic Blue* in gaskets with asbestos filler.

JENKINS PRACTICAL PIPING LAYOUTS 63

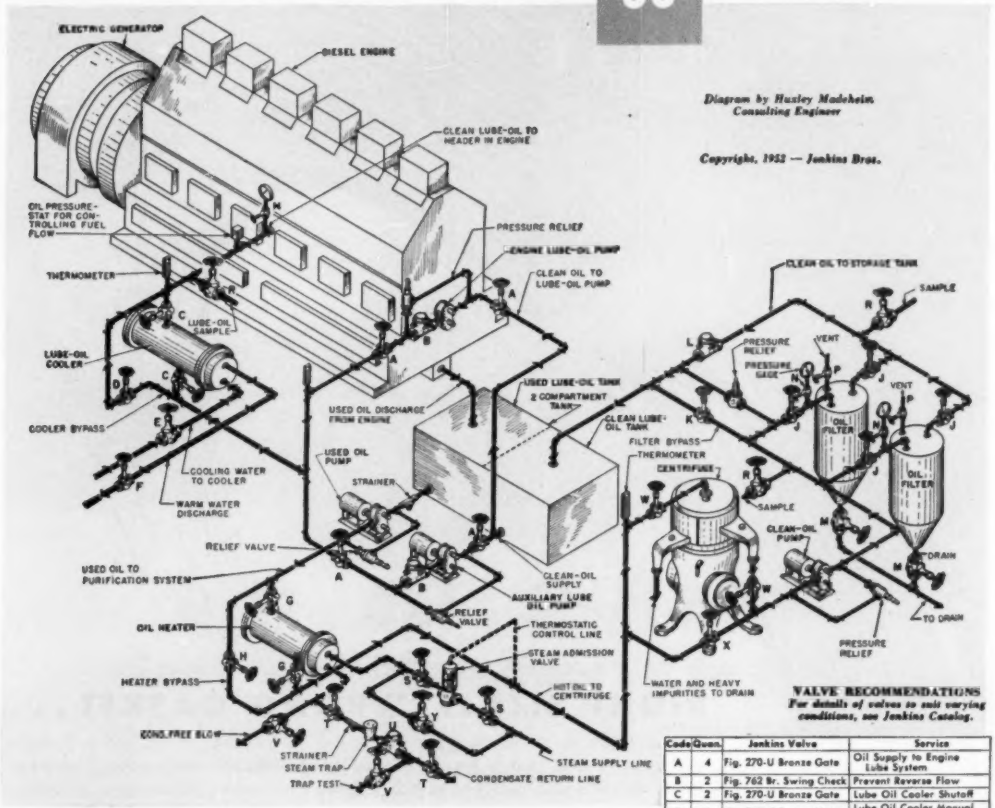


Diagram by Huxley Madeheim Consulting Engineer

Copyright, 1952 — Jenkins Bros.

VALVE RECOMMENDATIONS
For details of valves to suit varying conditions, see Jenkins Catalog.

Code	Quan.	Jenkins Valve	Service
A	4	Fig. 270-U Bronze Gate	Oil Supply to Engine Lube System
B	2	Fig. 762 Br. Swing Check	Prevent Reverse Flow
C	2	Fig. 270-U Bronze Gate	Lube Oil Cooler Shutoff
D	1	Fig. 270-U Bronze Gate	Lube Oil Cooler Manual Bypass
E	1	Fig. 950 Bronze Globe	Cool Water Supply to Lube Oil Cooler
F	1	Fig. 270-U Bronze Gate	Water Discharge Shutoff
G	2	Fig. 270-U Bronze Gate	Oil Heater Shutoff
H	1	Fig. 270-U Bronze Gate	Oil Heater Manual Bypass
J	4	Fig. 270-U Bronze Gate	Oil Filter Shutoffs
K	1	Fig. 270-U Bronze Gate	Oil Filter Manual Bypass
L	1	Fig. 762 Br. Swing Check	Prevent Reverse Flow
M	2	Fig. 950 Bronze Globe	Filter Drains
N	3	Fig. 743-G Br. Needle	Pressure Gage Control
P	2	Fig. 950 Bronze Globe	Filter Air Vents
R	3	Fig. 950 Bronze Globe	Oil Sampling Take Offs
S	2	Fig. 270-U Bronze Gate	Steam Supply to Oil Heater
T	2	Fig. 270-U Bronze Gate	Condensate Shutoffs
U	1	Fig. 762 Br. Swing Check	Prevent Condensate Backflow
V	2	Fig. 950 Bronze Globe	Condensate Bypasses Free Blow Trap Test
W	2	Fig. 270-U Bronze Gate	Centrifugal Shutoff
X	1	Fig. 270-U Bronze Gate	Centrifugal Bypass
Y	1	Fig. 956 Bronze Globe	Bypass on Automatic Steam Valve

How to plan a LUBRICATION OIL PURIFYING SYSTEM FOR DIESEL ENGINES

Lubrication oil purification systems are used on practically all modern diesel engines to assure longer oil life and decreased engine maintenance. Purification, however, must be accomplished without removing beneficial oil additives which increase lubricant efficiency and preserve bearing surfaces.

The diagram above shows a typical lubrication oil purification system designed to meet diesel engine needs. Circulated oil from the engine is returned to a tank and part or all of it is pumped through a heater. Here, it is raised to optimum cleaning temperatures. A centrifuge then removes water and impurities. The partially cleaned oil next passes through filters, where light impurities and colloidal carbon are removed.

In normal operation of the diesel, the lube-oil enters a clean oil storage tank, after which it is pumped back to the engine through a cooler, generally a shell and tube heat exchanger with water as the coolant, which reduces oil temperature raised during purification.

Consultation with accredited piping engineers and contractors is recommended when planning any major piping installations.

To save time, to simplify planning, to get all the advantages of Jenkins specialized valve engineering, select all the valves you need from the complete Jenkins line. It's your best assurance of *lowest cost in the long run*. Jenkins Bros., 100 Park Ave., New York 17.

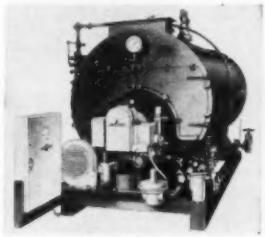
Complete description and enlarged diagram of this layout free on request. Includes additional detailed information. Simply ask for Piping Layout No. 63.

JENKINS VALVES
LOOK FOR THE DIAMOND MARK
SINCE 1864
Jenkins Bros

EQUIPMENT DEVELOPMENTS...

Boiler-Burner Units

HPAC 1*—New line of boiler-burner units consisting of a packaged burner complete with all controls, and a completely assembled "Scotch" boiler with accessory equipment for oil, or oil and gas, or gas firing. . . Units are available for high pressure steam and water in sizes ranging from 52 to 304 hp., 125 and 150 lb working pressure; also for low pressure 15 lb steam or 30 lb water, in sizes from 1,808,000 Btu to 8,400,000 Btu. They may be fired with No. 6 or lighter fuel oils, gas (either high pressure or as low as 2 oz) or a combination of both. The boiler portion is shipped to the job site from one manufacturer, the burner section, from another. Units are designed for forced draft operation, eliminating the necessity of a high stack. A small vent extending above the roof can be used. [Manufacturers: Iron Fireman Mfg. Co., Cleveland 11, for the burner, and Kewanee-Ross Corp., Kewanee, Ill., for the boiler.]



Boiler-Burner

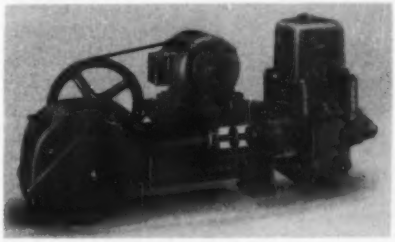
Insulation

Plastic Insulating Material

HPAC 2—"Plasticork" plastic material which allows on-the-job fabrication of insulating fittings for cold lines. . . . It is a tacky, moldable, granulated cork-and-rubber composition, furnished in bulk form, and can be shaped by hand. Used in any application where regular cork fitting covers can be applied, it is built up in the same thickness as molded fitting covers or the cork covering on adjacent piping. The material is non-corrosive on contact with all ordinarily used metals and maintains its plastic and tacky qualities indefinitely, according to the manufacturer. It can be removed from a fitting and reused. Containing 80 percent cork particles by volume, it is designed to provide covers whose over-all heat loss is comparable to that of cork fitting covers. [Manufacturer: Armstrong Cork Co., 440 Concord St., Lancaster, Pa.]

High Pressure Pumps

HPAC 3**—"Giant" heavy duty, high pressure shallow well reciprocating type pumps with capacities of 265 to 2700 gph. Powered by either electric motors or gasoline engines, they are slow speed, double-acting and self-



lubricating. Applications include industrial water supply or heavy duty applications for boiler feed and condensation return. A variety of plungers and valves are available to suit individual requirements. [Manufacturer: Lancaster Pump and Mfg. Co., P. O. Box 778, Lancaster, Pa.]

Units for Heating or Cooling

HPAC 4*—Cabinet units for heating, or for cooling with chilled water. . . . Cooling models are equally suitable for heating with water, the manufacturer states. Units

For your convenience in obtaining more information about any of this equipment, use this coupon. Add the new products and companies listed here to your Directory Section which you received in your January 1952 Heating, Piping & Air Conditioning, and thus keep your records of sources of supply up to date throughout the year. Single asterisk indicates equipment not listed in Directory Section; double asterisk, equipment and manufacturer not listed.

FOR YOUR CONVENIENCE [10-52]

Heating, Piping & Air Conditioning
6 N. Michigan Ave., Chicago 2, Ill.

Please ask the manufacturers to send me more information about equipment mentioned under these reference numbers in Equipment Developments and Recent Trade Literature

(Circle each HPAC number in which you are interested)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
16	17	18	19	20	21	22	23	24	25	26	27	28		
101		103	104		106	107	108	109		111	112	113	114	115
116	117	118	119	120	121	122	123	124		126	127	128	129	130
131	132	133	134	135	136	137	138	139						

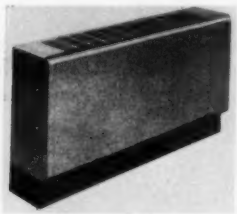
Name _____ Title _____

Company _____

Address _____

City _____ Zone _____ State _____

for heating only are available with a choice of three types of coils for use with either steam or hot water, steam only, or hot water only. Optional accessory equipment permits the introduction, filtering, heating and distribution of outside air for ventilation. This includes fresh air plenums with manually operated mixing dampers and, where desired, air filters. For a combination with winter heating, a steam distributing coil designed to minimize freezing is available. Five enclosure types are offered, which, when used with the optional equipment, can be installed in various positions, such as on the floor, wall, or ceiling, recessed in a wall, or concealed behind a partition or above a false ceiling. Capacities range from 120 to 640 EDR. Included in the line is a specially designed unit for blanketing doorways of stores with a curtain of heat. [Manufacturer: Modine Mfg. Co., 1509 De Koven Ave., Racine.]



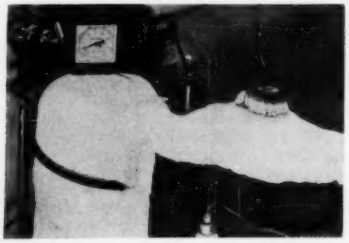
Above: Cabinet
Right: Boiler

Hot Water Boiler

HPAC 5**—Improved "Model 160" hot water boiler (Model C-2). . . . Btu output has been increased from 120,000 to 128,000 per hr, with 160,000 Btu input. Recovery rate has been increased from 240 to 256 gph, at 60 F rise. There are a new heat control adjusting knob, and an improved heat exchanger. Applications include commercial and industrial hot water supply, including restaurants, self-service laundries, hotels and other larger installations where the units may be hooked up in multiples. Dimensions are: height, 45½ in.; width, 21¾ in.; depth, 10½ in. [Manufacturer: McIntyre Engineering Co., Inc., Watrola Div., 137 S. Linden Ave., South San Francisco]

Solenoid Valve with Thermal Block

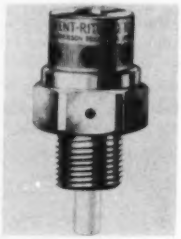
HPAC 6—Redesigned solenoid valves (Types 60 and 65) now equipped with a thermal block intended to prevent the absorption of coil heat by the cold valve body. . . . This eliminates moisture condensation in the coil chamber



which might short out the coil, the manufacturer states. Shown is an arrangement of the company's new and older solenoid valves mounted in the suction line of a "Freon 12" refrigeration system. According to the manufacturer, the experiment showed the thermal block to be an effective means of keeping the coil housing and coil washer above the dew point. [Manufacturer: The Electrimatic Co., 3501 Howard St., Skokie, Ill.]

Temperature-Humidity Indicator

HPAC 7—"Norwood" model of "Airguide" instrument line for indicating whether rooms have the proper balance of air temperature and relative humidity. . . . Proper conditions are indicated when both the temperature and humidity-indicating hands on the dial are in the same color zone. [Manufacturer: Fee and Stemwedel, Inc., 2210 Wabansia Ave., Chicago 47]



Above: Indicator
Right: Vent

Air Vent for Hot Water Systems

HPAC 8—"Vent-Rite No. 10" improved air vent, for automatic venting of hot water heating systems. . . . Features include a straight-line vent passage, special metering screw accessible from the outside of the vent, a new vent tube, and hygroscopic fiber discs for automatic opening, to allow air to vent and automatic closing to prevent passage of water. It is designed for pressures up to 30 lb per sq in. [Manufacturer: Anderson Products, Inc., 17 Tudor St., Cambridge 39.]

Desiccator for Airborne Instruments

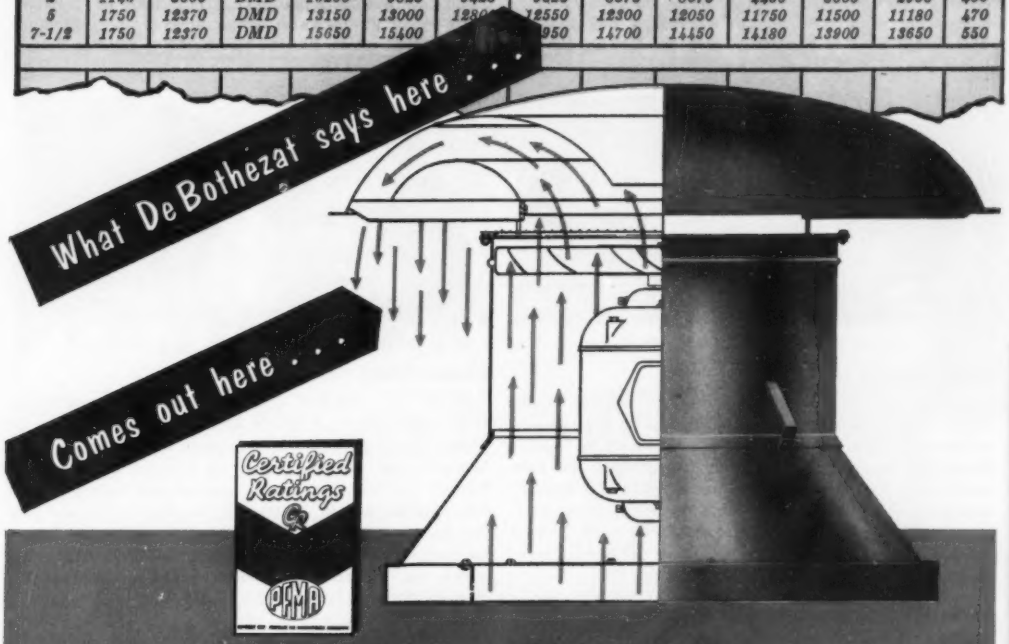
HPAC 9**—Miniature air conditioning system, developed to eliminate fogging, freezing and dirt-infiltration of aircraft gunsights, but available for other applications. The desiccator permits instruments to breathe air in and out to maintain pressure equilibrium as altitude changes. It also dries, filters and cleans air before it enters the instruments. A special induction heating device prevents freezing of moisture within the desiccator's valve mechanism. By the automatic application of heat, the desiccant (silica gel) is reactivated when altitude changes are made. The manufacturer has also begun work on new models in which this reactivation does not depend on altitude changes, for use in instrument storage cabinets, business machines, and other commercial applications. The present model, with an overall size of 4½ x 2½ x 2½ in., and weighing 13 oz, conditions air in airborne instruments containing up to 1 cu ft of volume. [Manufacturer: Daco Machine & Tool Co., 202 Tilry St., Brooklyn.]

Unit Heater

HPAC 10—Model 327 gas fired heater, thermostatically controlled. . . . Size and weight per Btu has been reduced to provide for easier hanging (within 6 in. of ceiling). Fan switch is thermally actuated so the fan cut-in is de-

CERTIFIED CAPACITY RATINGS

Motor HP	Fan RPM	Tip Speed	Drive	SP 0"	SP 1/8"	SP 1/4"	SP 3/8"	SP 1/2"	SP 5/8"	SP 3/4"	SP 7/8"	SP 1"	Net Wt.
2	1140	8060	DMD	10200	9825	9425	9025	8575	8075	4450	3600	2900	400
5	1750	12370	DMD	13150	13000	12800	12550	12300	12050	11750	11500	11180	470
7-1/2	1750	12370	DMD	15650	15400	[illegible]	950	14700	14450	14180	13900	13650	550



POWER-FLOW ROOF VENTILATOR RATINGS ARE OUTPUT OF COMPLETE UNIT, WITH HEAD . . . *NOT* OUTPUT OF FAN ALONE

When you specify DeBothezat Power-Flow Roof Ventilators, you can be sure that they will perform as rated. DeBothezat capacity ratings are the output of completely assembled units, INCLUDING THE HEAD, obtained from wind tunnel tests conducted in accordance with the Standard Test Code, Plate VI. They conform with U. S. Department of Commerce Commercial Standard 178-51, which embodies the test codes of ASHVE, NAFM and PFMA.

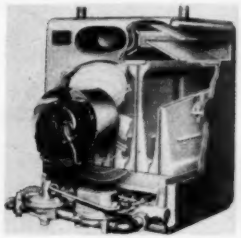
Power-Flow Roof Ventilators are available with fan wheels from 12" through 48" in diameter, with capacities up through 40,900 CFM. Next time you need roof ventilators, specify DeBothezat and get all the air you pay for.

New Catalog — Contains latest certified capacity ratings. Illustrations and specifications. For your copy, write our factory, Dept. HP-10-52, or phone your local DeBothezat agent.

DeBothezat Fans

Division of American Machine and Metals, Inc.
EAST MOLINE, ILLINOIS

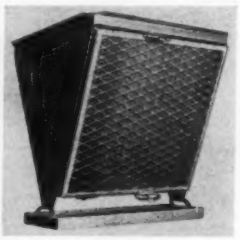
layed until heating element is up to temperature. Propeller-type fan is positioned to minimize noise. Vertical or horizontal control of heated air stream is possible due to two-way louver panel. Designed to be self-cleaning and to prevent clogging, each burner is centered under a single tube to provide more efficient heat distribution. [Manufacturer: Affiliated Gas Equipment, Inc., Bryant Heater Div., 17825 St. Clair Ave., Cleveland 10.]



Heater

Stapler

Humidifier



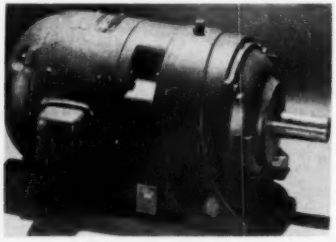
Filter

Staple Shooter for Insulation

HPAC 11**—Modified T5-8 outward clinch staple tacker, for clinching material when there is no backstop surface. . . . The original stapler was altered by Gustin-Bacon Co., Kansas City, Mo., to effect savings in the time required to fasten the overlapping edges of "Ultralite" insulation. The staples are designed to penetrate the overlapped surfaces and clinch in behind the joint without damaging the surface to be insulated. [Manufacturer: Bostitch, Inc., Westerley, R. I.]

Three-Piece Gear Motor

HPAC 12—Gear motor designed to simplify maintenance in case of electrical failure of the stator. . . . Built in three pieces to permit quick removal of defective stators, without disturbing gear components or connections, the



unit consists of a "Tri-Clad" motor, a planetary gear, and a mechanical adapter. The unit is available in ratings of 1 to 75 hp for standard applications and up to 200 hp for special applications. [Manufacturer: General Electric Co., Small and Medium Motor Dept., Schenectady 5.]

Humidifier

HPAC 13—Type F, self-contained humidifier, designed for use in industrial and commercial spaces which require automatically controlled humidification. . . . Units may be used for complete humidification systems, spot humidification in large spaces, for boosting the capacity of existing systems and for humidity control in laboratories. They are suspended from the ceiling, then connected to the water and electrical supplies. Water is atomized by centrifugal force and distributed horizontally through a 360 degree opening. Any part of the opening can be blocked off for directional distribution. Units evaporate up to 3 gph, and humidify several thousand cubic feet of room volume at normal conditions. They may be installed singly or in groups, with automatic control. [Manufacturer: Bahnson Co., 1001 S. Marshall St., Winston-Salem, N. C.]

Grease Filters

HPAC 14—"Far-Air" grease eliminator, designed to prevent accumulation of grease and lint in duct systems, to protect motor and blower equipment, and to reduce maintenance costs. . . . It is especially designed for restaurant kitchen ventilating systems where exhaust ducts present a fire hazard. A tray, which catches dripping grease that has been accumulated by the filters, is suspended below the unit. Filters may be cleaned by flushing under a hot water tap. [Manufacturer: Farr Co., P. O. Box 10187, Airport Station, Los Angeles 45.]

Heating and Ventilating System for Rapid Transit Cars

HPAC 15—Improved electronic car heating and ventilating system for electric powered rapid transit cars, that provides auxiliary heat in a three-step modulating action and features new type squeeze dampers to conserve heat and prevent drafts. . . . The system uses waste heat from resistors as a major source of supply. The thermostatically controlled squeeze dampers automatically reduce the volume of air going into the car when the resistor heat slumps. When this heat is more than required, the dampers conserve the excess heat by slowing the throw-away. In the summer, the controls automatically effect a pressure ventilating system after the outside temperature reaches a certain high point. [Manufacturer: Minneapolis-Honeywell Regulator Co., 2641 4th Ave., S., Minneapolis 8.]

Heater with Adjustable Vent

HPAC 16—Model VO 168 space heater, a 168,000 Btu unit with an adjustable vent, for permanent installation or portable use. . . . It sprays heated air across floor areas to form a 6 ft high blanket in the work zone. When used with a flue and vented outside, the model is recommended by the manufacturer for permanent use in confined areas such as small plants, warehouses, foundries, stores and offices. Heat output vented is 130,000 Btu per hr. When it is used without a flue, free heat is directed back into

[*Continued on page 202*]

A NEW INSULATION

Armstrong's PLASTICORK

Armstrong's Plasticork is a brand-new, low-temperature insulation. It's a cork-and-rubber composition that can be applied to any cold line fitting. The workman molds a Plasticork fitting cover right on the job—builds it up by hand over the fitting to be insulated.

Where fittings are close to each other or to wall surfaces, Plasticork makes the work faster and easier. It does away with the time-consuming task of cutting each regular cover to fit these difficult places.

Waiting for special factory covers causes delay on many cork covering jobs, too. With Plasticork, special fittings can be insulated immediately. You don't need factory covers for them.

Plasticork has excellent insulation value. It's 80% cork by volume. Applied in the same thickness as the cork covering on the adjacent piping, its efficiency is comparable to factory-made cork covers.

With Plasticork, you get a neat job that's difficult to distinguish from conventional covers. Plasticork holds its moldable characteristics for years. It's an item you can stock and use any time to insulate any fitting. It can even be removed and used again without loss of workability or efficiency.

Plasticork is shipped in cardboard cartons containing 5, 10, 20, and 40 lbs. Weight is 15 lbs. per cu. ft. Sundries for application can be supplied on order.

SEND FOR FREE BOOKLET:

Get a complete description of Plasticork, plus application specifications and coverage data. Write today for the 8-page booklet, "Armstrong's Plasticork." Address Armstrong Cork Company, 4410 Concord Street, Lancaster, Pennsylvania.

ARMSTRONG'S INDUSTRIAL INSULATIONS

1. Plasticork is packed firmly about fitting that has first been coated with Plasticork Primer.

2. Plasticork is then molded to the proper thickness and held in place with either twine or tape.

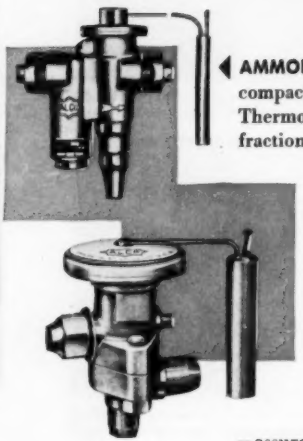
3. A ¼" thickness of Keene's Cement is trowelled to a smooth finish directly over the Plasticork.

4. Two coats of Armstrong's Weatherproof Plastic are brushed on to provide a tight vapor seal.

symbol of a job well done

There's an ALCO control for every application—large or small.

Installation of an ALCO VALVE assures steady, accurate refrigerant control... maximum coil efficiency... trouble-free refrigeration.



AMMONIA THERMO VALVES—have the same compact, come-apart design as all other Alco Thermo Valves. Large area strainers. From fractional tonnage to 125 tons.

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J-5 FLOAT SWITCH
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MULTI-OUTLET VALVES
—assures maximum coil efficiency on multiple systems. For all refrigerants and applications: ½ to 50 tons "Freon-12"; up to 50 tons Ammonia.

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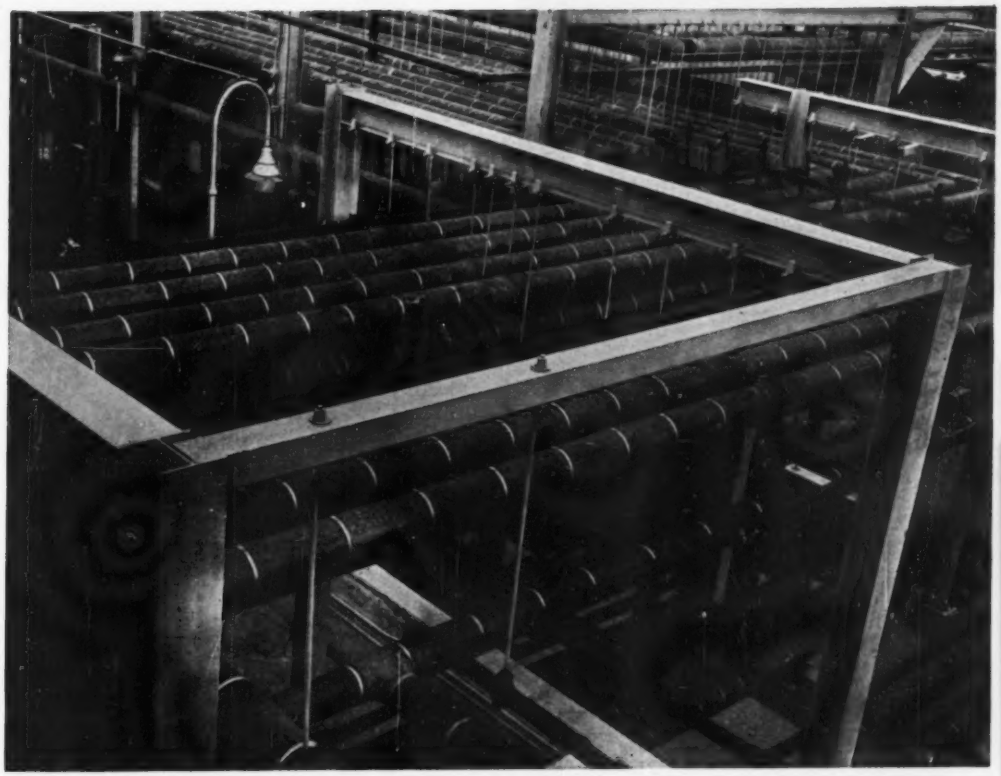

Outdoors, too, you can count on

"FEATHERWEIGHT" 85% Magnesia

You don't have to pamper "Featherweight" 85% Magnesia! This versatile, dependable insulation does the same efficient job outdoors as well as indoors, on any heating application up to 600°F.

The photograph above shows a part of one of the largest outdoor installations of its kind. The thousands of feet of pipe in this project carry various liquids and gases at many different temperatures. Some of the lines are traced with steam in ½" iron pipe; other lines are steam jacketed. In every case it is important that critical temperatures be held as closely as possible.

"Featherweight" 85% Magnesia, with a weatherproof covering, is an efficient insulation for this application. It will undoubtedly last the life of the plant—and *never* lose its efficiency!

Such service is to be expected of this remarkable material. "Featherweight" 85% Magnesia is structurally strong. It withstands reasonable compression, vibration, and contact. It is physically inert, and its insulating qualities are unaffected by alternate heating and cooling. It is entirely mineral, thus, will not burn. When used along with K&M Hy-Temp Insulation, its usefulness is extended to applications up to 1900°F.

Your Keasbey & Mattison Distributor is an experienced applicator able to answer your questions about "Featherweight" 85% Magnesia. See him, or write us direct for more information.

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Double check the time-cost of assembling pipe hangers with the pipe. That's one way to get a conviction that pipe hangers can be time-cost saving tools. Then, use Square "Gee" Pipe Hangers on your next plumbing and heating jobs and you'll know for sure that pipe hangers can reduce installation cost because Grabler Square "Gee" Pipe Hangers give relief from time-wasting grief. Ask your wholesaler for Grabler Square "Gee" Pipe Hangers.

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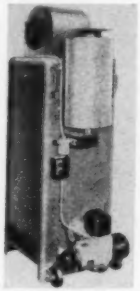
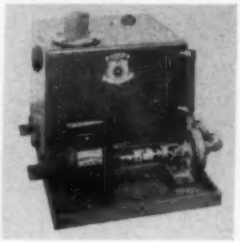
GRABLER

[*Continued from page* 198]

the blower and discharged "superheated", increasing the output to 168,000 Btu per hr. The unit operates from a detached fuel supply, burning No. 1 or No. 2 fuel oil, kerosene or diesel oil. Dimensions are 21 x 33 x 69 in., and weight is 345 lb. [Manufacturer: Fageol Heat Machine Co., 5725 Mt. Elliott Ave., Detroit 11.]





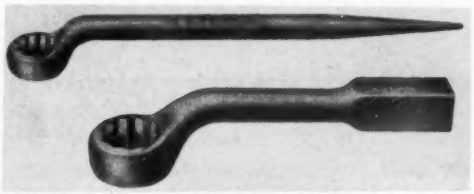
Above: Pump
Left: Heater

Condensate Pump

HPAC 17—Improved "Eagle" condensate unit which now has flexible connectors on both suction and discharge of the pump, and flexible couplings isolating the pump (for preventing pipe cramp and misalignment). Capacity is 8000 sq ft EDR at 20 psi. The low inlet, 2 in. IPS, is 12 in. from the floor. The centrifugal pump is all bronze and the standard ¼ hp capacitor motor operates on 115 volts. Thermal overload protection is provided. [Manufacturer: Walter H. Eagan Co., Inc., 2336 Fairmont Ave., Philadelphia 30.]

Box Wrenches

HPAC 18—Structural box and offset striking-face box wrenches, in which head walls have been reproportioned. . . . Thinner head walls permit the use of these wrenches on a broader range of American Standard bolted



flanges and flanged couplings. The usable life of these wrenches remains the same, the manufacturer states. [Manufacturer: J. H. Williams & Co., 400 Vulcan St., Buffalo 7.]

Overfire Draft Control

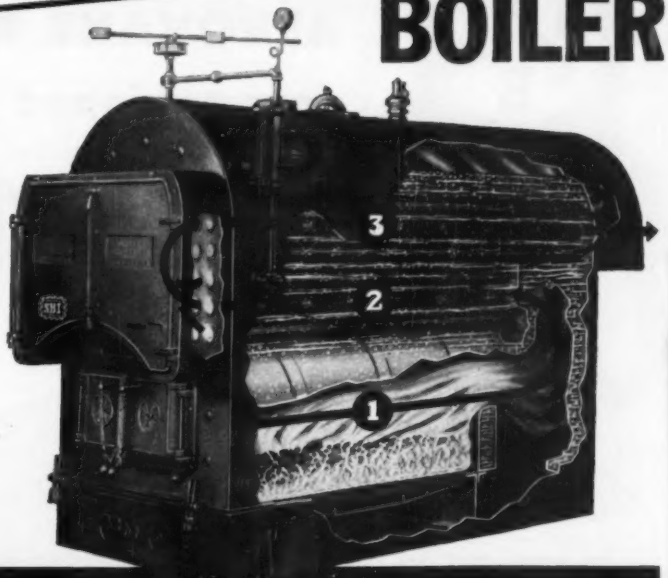
HPAC 19**—Overfire draft control with electronic time delay. . . . In gas or oil applications, when no heat or power is required, it maintains the breeching or stack damper in a closed position, minimizing boiler room air that goes through the boiler and furnace. For burner operation, the control, connected to the control circuit, causes the damper to move to the wide open position. This operation requires 60 seconds, the full draft being available for a large portion of that time, providing a

[*Continued on page* 206]

This is the Compact Type **STEEL BOILER**

with the famous

BURNHAM FIRE TRAVEL*



***3 times-back-and-forth fire travel means heat transfer is more efficient — you get more BTUs per unit of fuel!**

THE BURNHAM "COMPACT TYPE" Welded Steel Boiler with this famous feature is notable for low flue temperatures, high boiler efficiency and low fuel costs. Capacities for SBI Steam Hand-fired range from 3,000 to 35,000 sq. ft. and SBI Steam Automatic from 3,650 to 42,500 sq. ft.; SBI Hot Water Hand-fired range from 4,800 to 56,000 sq. ft. and SBI Hot Water Automatic from 5,840 to 68,000 sq. ft.

Long experience and intensive research have produced in this efficient BURNHAM Steel Boiler the last word in quality and dependability.

Some of its outstanding features are: Large steam dome permitting quick, easy steaming without priming. Rapid, continuous water circulation for efficient heat transfer. All sediment settles away from hot surfaces. Low water line for easy installation and piping. Plenty of clean-out plugs.

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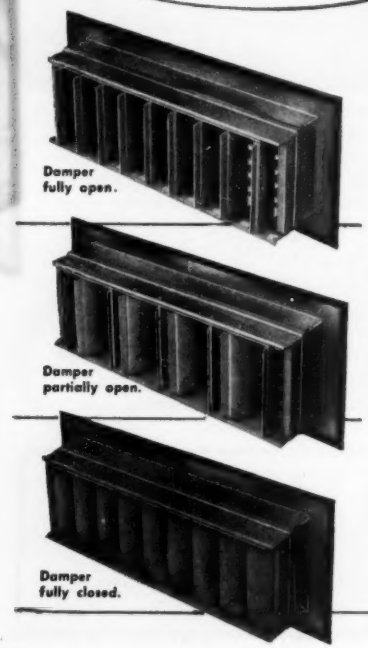
Blades are regulated by key operator which may be removed or tapped permanently into place.



Damper fully open.

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Damper fully closed.

TRI-FLEX Supply Air Registers and AEROVANE Return Air Registers — specified and installed on important air conditioning jobs — are now constructed with opposed blade dampers.

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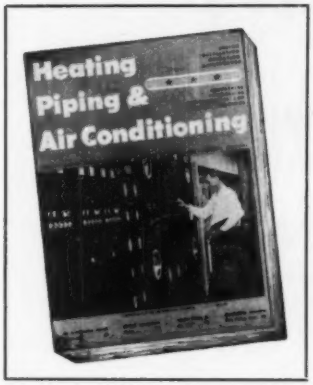

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[Continued from page 202]

purging period for removing any gas which may have accumulated. When the damper is in the wide open position, the sequence control is designed to close the circuit, thereby starting the operation of the burner control equipment. The control when used for coal is identical to that used for gas or oil except that the damper is not closed during standby operation. [Manufacturer: Bressler Engineering Service, Oregon, Ill.]

Control

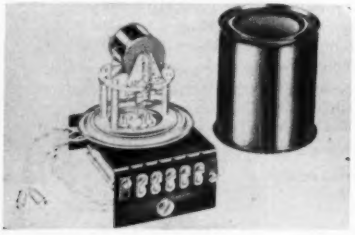
Coating

Plastic Gasket Material

HPAC 20—Plastic gasket material for coating flange faces and gasket surfaces in order to reduce line leakage . . . . A film of 1/64 in. is used. According to the manufacturer, a slight leakage which may occur after the line has been in service can be corrected, without dismantling flanges, by applying 1/32 in. of the material around the outside surfaces of the flanges where they meet with the gaskets. Where flange faces are unmarred and come together the material can be used by itself, without any other type of gasketing material. The material is formulated in two types: for air, steam, water and mild chemicals; and for oil, gasoline, solvents, etc. [Manufacturer: Flexrock Co., 3603-K Filbert St., Philadelphia 4.]

Synchronous Inverter

HPAC 21—"Syncroverter Switch", a synchronous inverter designed for a sensitivity of 0.05 microvolts and a dissymmetry of less than ½ of 1 percent. . . . It converts low power d-c signals to alternating voltages that can be



amplified and applied to electronic, electrical and servo systems. Designed for precision use in electronic computers, instruments, etc., the inverter operates at any frequency from 0 to 3500 cycles. [Manufacturer: The Bristol Co., Waterbury 20, Conn.]

Corrosion-Resistant Coatings

HPAC 22—"Ricwilite" phenolic resin coatings designed to protect equipment against extremely corrosive conditions

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HERMAN NELSON

Horizontal Shaft Propeller-Fan Type Unit Heater—*the most generally useful of all space heaters.*

Vertical Shaft Propeller-Fan Type Unit Heater—*especially suited to buildings with high ceilings—up to 50 feet.*

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herman nelson moline illinois

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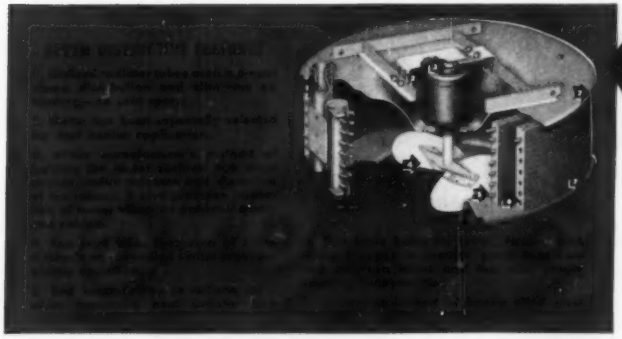
Zero outside and the attendants in this pipe line pumping station work in comfort. For this and every other station of the gas transmission company are heated by Herman Nelson Vertical Shaft Unit Heaters.

Designed especially for high-ceiling buildings, this particular unit heater is widely used throughout industry. It operates on either steam or hot water. Its functional design and construction insure easy installation and minimum maintenance. It is modernly styled and attractively finished.

Far-sighted research, sound engineering, rugged, long lasting materials and superior craftsmanship make Herman Nelson tops in unit heaters —insure that they will give a lifetime of efficient, economical, trouble-free service.



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Herman Nelson Unit Heaters are suitable for the smallest service station or the largest factory. Each size unit does an extremely efficient job of heat transfer and distribution. This is because *both* heating element and fan are unique in design. Study the 7 points listed on the left and you'll see that every part has been carefully engineered to do its particular job.

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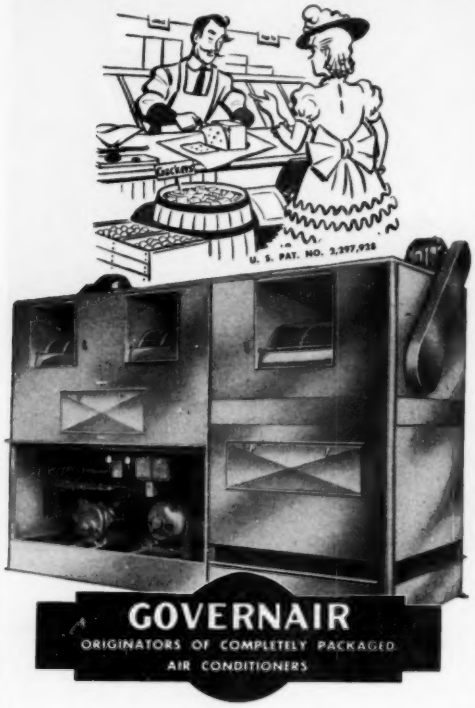
Packaging has improved lots of things



Packaging makes many products more efficient, more convenient and more acceptable these days. And large size packaged air conditioners (up to 60 tons) are no exception!

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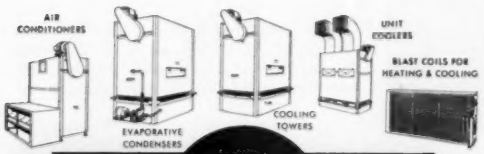
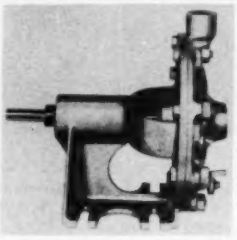


with a tough film which resists corrosive acids, alkalis, salt water, rust, and weather. . . . One type hardens to form a chemically inert coating when baked at 350 to 400 F. Another, of the cold-setting type, is cured at room temperatures (60 to 80 F) by the addition of a catalyst just prior to application. It can be applied to metals, concrete, wood and plaster surfaces by brush or spray. [Manufacturer: Ric-Wil Plastic Coating & Mfg. Corp., 1290 Euclid Ave., Cleveland 15.]

Reversible Centrifugal Pump

HPAC 23—Model CAY centrifugal pump designed to operate with equal efficiency when rotated in either direction. . . . It is intended primarily for circulating cooling water in air compressors, diesel and gasoline engines and other water cooled machines. Advantages of the reversible pump are said by the manufacturer to include easy installation in any position on a machine, simplified piping design, and adaptability to any type of drive. It is suitable for heads up to 50 ft and capacity up to 67 gpm. [Manufacturer: Gardner-Denver Co., Quincy, Ill.]



Pump

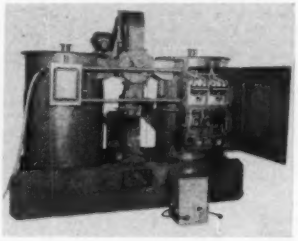
Vise

Pipe Vise

HPAC 24—"Ridgid" No. 40 "Tristand" pipe vise, intended as a portable workbench. . . . It has a top tray with pipe benders and a pipe rest, and a tool tray below which prevents the unit from folding up in use. Capacity of the yoke vise is 2½ in., of the chain vise, 4 in. [Manufacturer: The Ridge Tool Co., Clark St., Elyria, Ohio.]

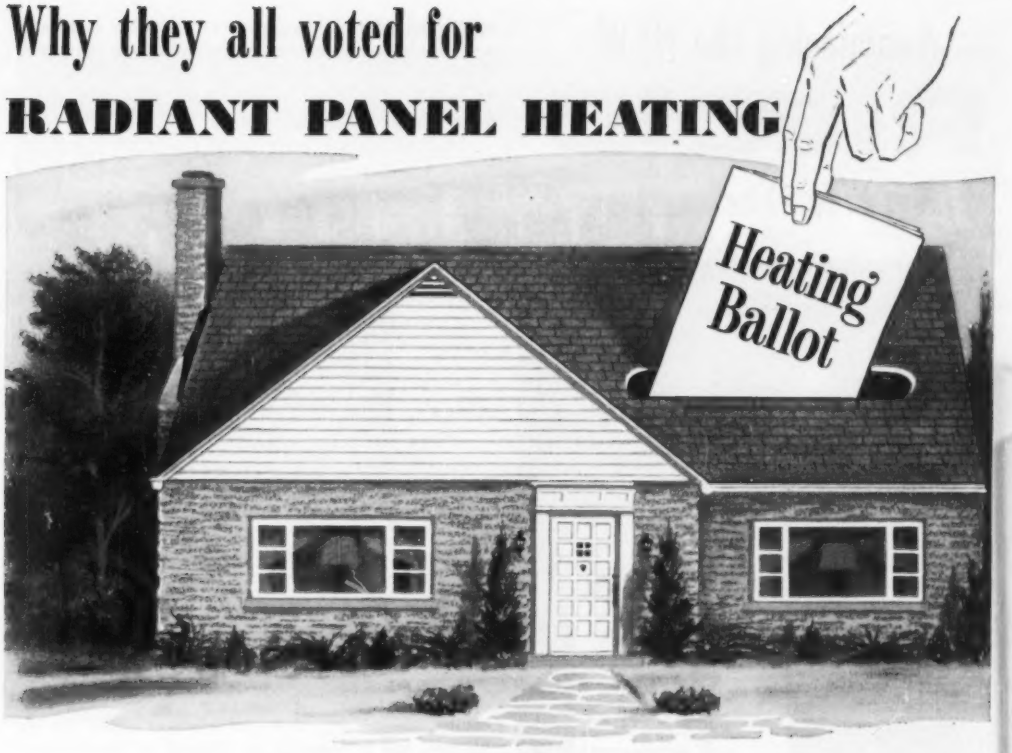
Automatic Dehumidifier

HPAC 25—Adsorbent type automatic dehumidifier (DOR-800) designed to maintain a relative humidity of 35 to 40 percent, 'year round, in unheated buildings. . . . Now being used in Navy warehouses for long term storage



of equipment, it is also available for industrial use in storage and packaging rooms with or without additional refrigeration for after-cooling. The unit has a dry air volume of 1500 cfm and removes 500 lb of water per 24 hr at air conditions of 70 F dry bulb and 35 percent

Why they all voted for
RADIANT PANEL HEATING



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Architect

"*Keeping up with the Joneses* took on a new meaning for me when they asked me to plan their new house. They knew what they wanted and they wanted the most modern of everything. But when it came to the heating system I was way ahead of them. When I explained Radiant Panel Heating they went for it in a big way!"

Wife

"I wanted what my husband did, too, but more than that I wanted *freedom to decorate.* Because our Radiant Panel heating *units* are concealed beneath the floor, or in the ceiling, every inch of every room is now mine to use. My rooms seem larger! I can place my furniture as I please!"

Husband

"After dreaming about building a new house for years I knew exactly what I wanted in a heating system. Comfort, warm floors, uniform temperature, freedom from drafts, more vital air, no hot or cold spots. Radiant Panel Heating was the answer."

Builder

"Radiant Panel Heating is easy to install in a new house, and my heating men *know* steel pipe. They're used to handling it. They know it's been proved in more than 60 years of hot water and steam heating applications; that it's formable and weldable for fabricating coils and grids. That's why, for radiant heating, snow melting, and other applications, *steel* is the most widely used *pipe* in the world!"

A free 48 page color booklet "Radiant Panel Heating with Steel Pipe" is available. Write for your copy.

Steel Pipe is First Choice

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AMERICAN IRON AND STEEL INSTITUTE
350 Fifth Avenue, New York 1, N.Y.

Announcing the NEW

RIDGID

Spiral Reamer

NOW fast easy reaming with the new RIDGID 2-S Spiral

★ Reams pipe fast, easily and cleanly.

★ Makes quick work of enlarging conduit box outlets—cuts holes in sheet metal, smoothly, no chatter. Reams soil pipe.

★ Special design blades feed into metal at lightest pressure, cut it like wax.

★ Typical RIDGID tested design, fine craftsmanship and materials—extra long service for your money.

★ Buy the new 2-S spiral at your Supply House.

Reamer unit sold separately—
fits your RIDGID OOR threader handle

THE RIDGE TOOL COMPANY • ELYRIA, OHIO

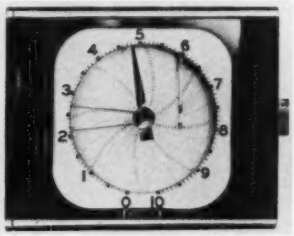
RIDGID

Work-Saver Pipe Tools

relative humidity. The manufacturer's smallest model also is shown. [Manufacturer: Desomatic Products Div., Daly, Merritt & Sullivan, Inc., 1109 W. Broad St., Falls Church, Va.]

Round Chart Recorder

HPAC 26—Round chart recorders and automatic controllers have been added to the line of electronic "Dynamaster" potentiometers and bridge instruments. The round chart models are null-type electronic instruments



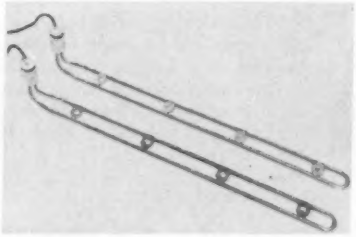
which can be used to measure any variable that can be translated into an electrical quantity, such as d-c current, d-c voltage, capacitance, or resistance. Typical sensing elements that can be used with the new instruments include thermocouples, resistance thermometer bulbs, etc. [Manufacturer: The Bristol Co., Waterbury 20, Conn.]

Diaphragm Valve Operator

HPAC 27—Air motor, automatic, diaphragm-type operator for use on valves normally open, normally closed, three-way or slides. . . . It operates by means of pneumatic pressure applied to the chamber above the diaphragm, and is adaptable for manual or remote control systems. Available in 13 and 16 in. diaphragm sizes (standard), it is especially suitable for modulating control of valves where accurate control of flow is desired with applied diaphragm pressure, the manufacturer states. [Manufacturer: General Controls Co., 801 Allen Ave., Glendale 1, Calif.]

Heater for Welding

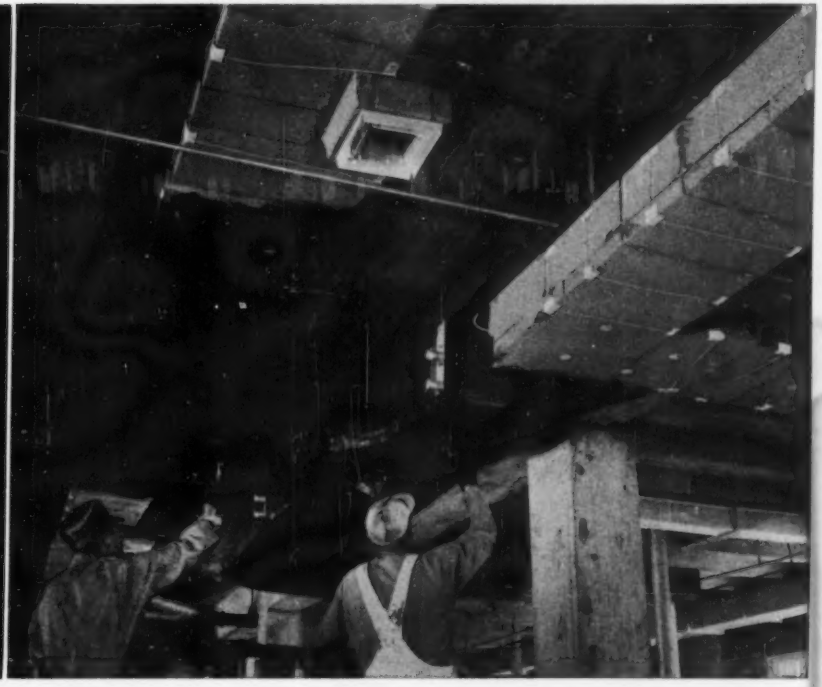
HPAC 28—"Chromalox" electric tubular heater for use in welding steel pipe and plate. . . . It is designed to reduce the temperature differential between the weld area and adjacent metal. Heaters placed between the weld line and larger sections of cold metal form a "heat dam" which



slows conduction of heat away from the weld. Special heater shapes may be attached to fit the heat to various weld contours. For straight line welds, heaters are held in place about 6 in. from the weld line by bolting them to tack-welding studs. [Manufacturer: Edwin L. Wiegand Co., 7610 Thomas Blvd., Pittsburgh 8.]

The Moses H. Cone Memorial Hospital, Greensboro, N. C.
Architects: Samuel Hannaford & Sons, Cincinnati, Ohio Consulting Engineers: Watson & Hart, Greensboro, N. C.
Insulation Contractor: Starr Davis Company, Inc., Greensboro, N. C. General Contractor: J. A. Jones Construction Company, Charlotte, N. C.

Take a tip from this picture



use FOAMGLAS for concealed insulating jobs — then forget about failure!

● *You'll be sorry* if you don't use the very best insulation for inaccessible locations. No matter how carefully it is installed, you cannot rely on ordinary insulation to stay free from moisture—the number one destroyer of most insulations.

But you can forget about failure, even in concealed locations, when you use FOAMGLAS. In the above picture, for instance, they are applying a finish to FOAMGLAS-insulated ducts to be above a permanent ceiling. Here is one place where insulation failure would be intolerable, because of the tremendous cost of tearing out the ceiling, replacing the insulation, and restoring the ceiling.

Since FOAMGLAS resists water and will not transmit water vapor, it is the perfect insulation for a job like this. FOAMGLAS consists of millions of tiny air cells sealed in pure glass. FOAMGLAS contains nothing *but* glass. There are no organic fillers or binders to rot, burn or provide a nesting place for vermin.

The best way to learn about FOAMGLAS is to send the coupon below. We'll ship a free sample of FOAMGLAS and a copy of our latest booklets.

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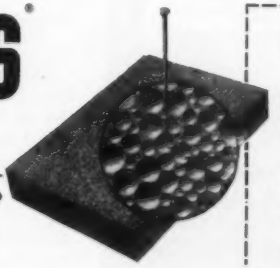
PITTSBURGH PC CORNING

FOAMGLAS®

the cellular glass insulation

The *best* glass insulation is cellular glass. The *only* cellular glass insulation is FOAMGLAS. This unique material is composed of still air, sealed in minute glass cells. It is light weight, incombustible, verminproof. It has unusually high resistance to moisture, chemicals and many other elements that cause insulation to deteriorate.



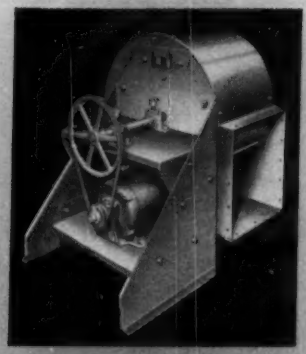
Pittsburgh Corning Corporation
Dept. AF-102, 307 Fourth Avenue
Pittsburgh 22, Pa.

Please send me, without obligation, a sample of FOAMGLAS and your FREE booklets on the use of FOAMGLAS for: Normal Temperature Commercial, Industrial and Public Buildings ☐ Refrigerated Structures ☐ Piping and Process Equipment ☐

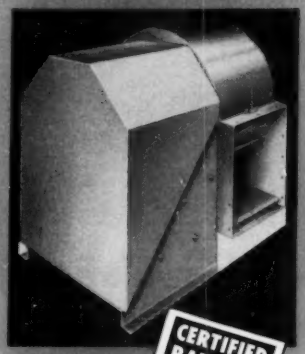
Name.....

Address.....

City.....State.....



ALADDIN UTILITY SETS



COMPACT

TEN SIZES

BELT DRIVEN

SELF CONTAINED

QUIET OPERATING

CERTIFIED RATINGS

AUTHORIZED BY N A F M

ALADDIN Belt-Driven Utility Sets are extremely quiet in operation. Designed for general ventilation, they occupy a minimum of space, handling large volumes of air at low noise levels. They are ruggedly built and are ideally suited for roof installation . . . when furnished with weatherproof cover they require no further protection against the weather.

ALADDIN Utility Sets are available with both forward curved or backwardly inclined blade wheels.

Write for complete data

ALADDIN HEATING CORPORATION

2272 SAN PABLO AVE., OAKLAND 12, CALIFORNIA

REPRESENTATIVES IN ALL PRINCIPAL CITIES IN THE WEST

WE HEAR THAT . . .

After 55 years as president of *C. W. JOHNSON, INC.*, Chicago, *CARL W. JOHNSON* has become chairman of the board. Other officers now include *C. W. DeLAND*, president; *C. M. VREULS*, vice president; *G. A. JOHNSON*, treasurer; and *C. W. BLODGETT*, secretary.

DETROIT LUBRICATOR CO., Detroit, has announced that the name of the company has been changed to *THE DETROIT CONTROLS CORP.* in order to more accurately describe its products. It will continue as a division of the American Radiator & Standard Sanitary Corp.

To strengthen its middle western and eastern market operations, *GENERAL CONTROLS CO.*, Los Angeles, recently opened a new plant at Skokie, Ill. The opening was highlighted by a luncheon attended by the mayors of Chicago, Skokie and surrounding towns, civic officials, and others. Built at a cost of approximately $750,000, the plant comprises 60,000 sq ft of floor space located on a five-acre lot. It offers manufacturing, warehouse, office and servicing facilities.

CARRIER CORP., Syracuse, has contracted to purchase from Syracuse University the land and industrial buildings that adjoin the company's principal plant. The property includes 110 acres of land.

A new series of educational shows, designed for heating and refrigeration engineers and servicemen, was inaugurated in Cleveland, October 2, and is travelling through several northeastern states. Sponsored by *PENN CONTROLS, INC.*, Goshen, Ind., the show covers the function and operation of heating and refrigeration controls.

WAGNER ELECTRIC CORP., St. Louis, recently purchased from the Fulton Iron Works Co. three acres of land adjoining the Wagner plant. Consisting of four buildings and 100,000 sq ft, the property will be used to increase the company's transformer manufacturing capacity.

J. E. WILLIAMS has been named general manager of the *RAMSET DIV.*, Cleveland, recently acquired by *OLIN INDUSTRIES, INC.*, East Alton, Ill. Mr. Williams is former president and founder of three companies which have become Olin subsidiaries.

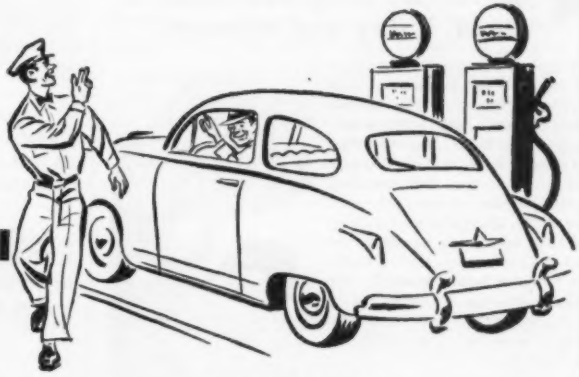
CALUMET & HECLA CONSOLIDATED COPPER CO., Boston, is planning to unwater and reopen the Osceola Lode Mines at Calumet, Mich., which have been closed since 1931. It is estimated that 106 million pounds of copper will be produced in the next ten years.

A. H. LOCKRAE, vice president, *MINNEAPOLIS-HONEYWELL REGULATOR CO.*, Minneapolis, has retired because of ill health after 30 years with the company.

"SEE YOU AT THE POLLS!"

"SEE YOU AT THE POLLS!"

"SEE YOU AT THE POLLS!"



Nobody knows for sure how it started—this line about "See you at the Polls!" we're hearing all over these days.

Best explanation seems to be that it came from that state candidate out west. . . . His opponent in a debate got all riled up and challenged him to fight it out in the alley.

But he said—"I'll settle this the AMERICAN way—I'll see you at the polls!" And the audience picked up the chant.

Now everybody's saying it—and on Nov. 4 everybody will be *doing* it!

"SEE YOU AT THE POLLS!"

"SEE YOU AT THE POLLS!"

SAVE

MORE THAN EVER . . . NEW

Ramset JOBMASTER

and *Tru-Set Fasteners*
for steel and concrete fastening

star values bring new ease, speed, utility and economy

SEE the new RAMSET JOBMASTER that fastens **in split seconds** into steel or concrete. Check the big, **10-Star Values** for faster, easier, better fastening than ever before. **One-Piece Tool** and **Trigger Action** for quick, simple loading and firing. **Self-contained Barrel Extension,** always ready when needed. **Gas Diverter** to stop spalling. **Visi-Chek Button** and **Manual Safety Control** for positive protection. Exclusive **Roto-Set Safety Shield** for pinpoint positioning. All these add up to the greatest work-saving, time-saving, money-saving advantages in the industry.

Always Use Tru-Set Fasteners

When you add these JOBMASTER values to the advantages of Tru-Set Fasteners, with the exclusive Red-Tip Pilot that guides them straight to the work, you've got an unbeatable combination for ease, speed, utility and economy. With 54 sizes and types, there's a Tru-Set Fastener for almost any job. Ask your RAMSET Dealer today for Fastener Specification Booklet, and demonstration of how this RAMSET team can cut fastening costs and get work finished faster. Remember, RAMSET SYSTEM is the pioneer in powder-actuated fastenings —with more enthusiastic, satisfied users than any other tool.

Ramset Fasteners, INC.
Division of Olin Industries, Inc.
12117 BEREA ROAD • CLEVELAND 11, OHIO

In charge of the heating controls division for the past 10 years, Mr. Lockrae now is planning to live on his ranch at Patagonia, Ariz.

AIR CONTROL PRODUCTS, INC., Coopersville, Mich., recently started construction of a new office and plant to supplement the company's other four plants. One of the features will be what is probably the largest perimeter heating system ever to be installed, according to the company. The entire office will be heated with forced warm air, the installation being used as a basis for research in the field of application of perimeter heating to large installations. The heat loss of the office is estimated at 800,000 Btu per hr.

A new corporation, *LEE-DON, INC.*, Harmarville, Pa., has been formed to produce and sell a new densifier, "Heatcrete," an ingredient of heat-conductive concrete for radiant heating. *LEVI C. McGRADY* is president. *DONALD H. BUTLER*, owner of Products Planning Co., Pittsburgh, which developed the densifier, is vice president.

A new course in heating is being offered by *INTERNATIONAL CORRESPONDENCE SCHOOLS*, Scranton, Pa. The course, heating drawing and estimating, is designed for mechanics in the heating field.

EUTECTIC WELDING ALLOYS CORP., Flushing, N. Y., through its welding institute, is sponsoring a series of weekly classes in advanced welding technique. New sessions start every two weeks through the end of the year.

A new award for distinguished achievement in the field of gas distribution has been established by the *AMERICAN GAS ASSOCIATION*, New York. The award, to be made under the auspices of the operation section, is sponsored by the American Meter Co., Philadelphia. It consists of $1000, a certificate and a token, which will be presented at the association's annual convention.

To simplify product recognition, the name "Eclipse" will be used to identify all gas and oil-fired industrial appliances manufactured by *ECLIPSE FUEL ENGINEERING CO.*, Rockford, Ill. All products formerly marketed under the "McKee" name now will have the new trademark.

WOLVERINE TUBE DIV., Calumet & Hecla Consolidated Copper Co., Detroit, has opened a new mill depot at 1500 S. Western Ave., c/o Midland Warehouse, Inc., in Chicago. *E. J. CAMPBELL*, midwestern district sales manager, will supervise the new operation from the company's Chicago headquarters.

A 22-minute color, sound movie produced by the *ALLOY RODS CO.*, York, Pa., shows how arc welding electrodes are manufactured. First showing of the film will be at the National Metal Exposition in Philadelphia, October 20-24. It will be made available for general distribution.

WHO'S WHAT

GRANT WILSON, Grant Wilson, Inc., has been named co-chairman (for the mechanical group of the building industry) of the *ART INSTITUTE OF CHICAGO* emergency fund committee. Other members on the committee are: for heating, air conditioning and plumbing contractors, *ROBERT E. MURPHY;* pipe manufacturers, *W. A. TAYLOR*, Taylor Supply Co.; stoker, oil burner and incinerator manufacturers, *E. W. JONES*, Iron Fireman Mfg. Co.; heating equipment manufacturers, *R. E. SHOBERG*, Kewanee-Ross Corp.; fan, ventilator, exhaust and filter manufacturers, *JOHN M. FRANK*, Ilg Electric Ventilating Co., and for pipe and boiler covering contractors, *MATTHEW J. FITZGERALD*, Standard Asbestos Mfg. Co.

F. H. EBBERT has been appointed vice president and general sales manager, *GUSTIN-BACON MFG. CO.*, Kansas City, Mo. He has been vice president and sales manager of the company's Automotive Div. since 1946.

Six executives of *FAIRBANKS, MORSE & CO.* recently have been promoted. *PAUL R. FLOOD*, formerly manager of manufacturing at the Beloit (Wis.) Works, has been named general manager of the Pomona, Calif., Pump Works. He succeeds *CHARLES L. BARRETT* who has become consultant to the Pump Div. *LEWIS H. KESSLER* has been named chief hydraulic engineer at the Beloit Works, succeeding *R. C. GLAZEBROOK* who is on special assignment to the general manager. *ROBERT B. CRAIG* has been appointed assistant to the president, with headquarters in the Washington, D. C., office. *S. L. FRY*, formerly manager, Omaha branch Diesel Dept., now is assistant manager, Pump Sales Div., Chicago.

THOMAS A. COLLINS has been elected to the newly-created post of executive vice president of *GLASS FIBERS, INC.*, Toledo. He previously had been general manager of Kaylo Div., Owens-Illinois Glass Co.

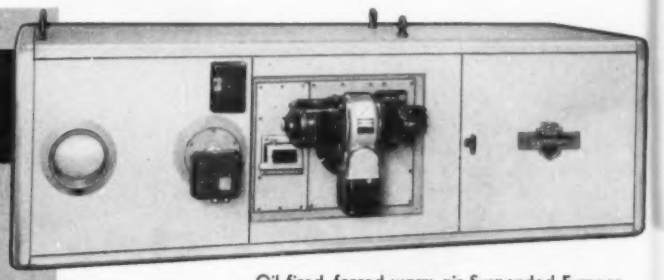
ALLAN H. ROGERS, superintendent of public works, Garden City, N.J., was elected president of the *AMERICAN PUBLIC WORKS ASSOCIATION* at its recent annual meeting in Los Angeles.

GEORGE O. MANIFOLD, has been appointed director of education of *HAGAN CORP.*, Pittsburgh. He is professor of mechanical engineering at the University of Pittsburgh. Courses will cover combustion and process control systems and various types of equipment.

FREDERICK S. MALLETTE, assistant director of research in charge of air pollution control activities, American Steel and Wire Div., United States Steel Co., has been appointed executive secretary of the committee on air pollution control of the *AMERICAN SOCIETY OF MECHANICAL ENGINEERS.*

for UNUSUAL INSTALLATIONS

THE Waterbury Suspended FURNACE



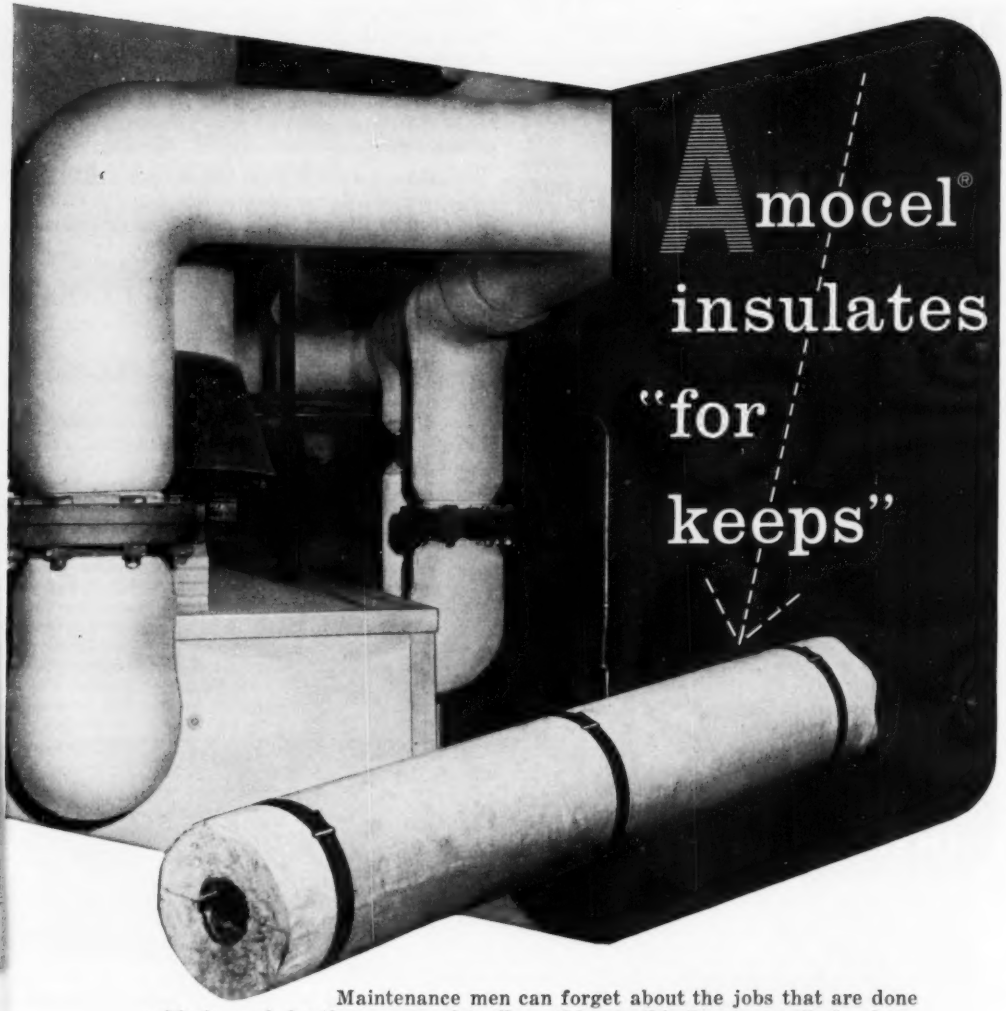
Oil-fired, forced warm air Suspended Furnace

With floor space at a premium, a special heating unit is a definite need. Waterbury successfully meets this need with the Suspended Furnace—the newest addition to the Waterbury line.

Waterbury manufactures a complete line of furnaces and winter air conditioners, with a unit for every size home and every type of fuel.

Commercial buildings, industrial plants, and certain homes require a suspended warm air heating unit to conserve valuable floor space. A "package" unit, assembled at the factory, the Waterbury suspended furnace has all parts readily accessible from the front, for easy inspection, cleaning, and servicing. Air filters and a large capacity blower are standard equipment in this space-saver, which can be suspended in a crawl space under the floor, from the basement ceiling, in the attic, or in any portion of a building where more space is available at ceiling level than on the floor.

The Waterman-Waterbury Co.
OVER 45 YEARS OF WARM AIR HEATING
1152 Jackson St. N. E. Minneapolis 13, Minnesota



Maintenance men can forget about the jobs that are done with Amocel, for time means virtually nothing to this "permanent" pipe insulation. It's Unarco's exclusive development for low-cost commercial use on steam and hot water lines and for all other work within 600°F., maximum. Amocel has many of the fine extra-service features formerly found only in Unarco's higher-temperature insulation, Unibestos. You'll like its easy application; its money-saving, long-lived efficiency.

UNARCO

Write for Bulletin No. 76-109, and the name of the Unarco Warehousing Distributor in Your Area

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UNARCO

Distributor of the Month

Fuel Economy Engineering Co.

508-9-10 NEW YORK BUILDING

SAINT PAUL 1, MINNESOTA

Recommendations backed by thirty-three years of power plant and heating experience, and quality Unarco Insulations, are quickly available throughout the North Middle West from the Fuel Economy Engineering Co.

Strategically located branches and a convenient central warehouse assure prompt attention from qualified sales engineers and immediate "from stock" deliveries.

If you are located in Minnesota, North or South Dakota, Eastern Montana, Northern Iowa, Western or Northern Wisconsin, or the Upper Peninsula of Michigan, write or call Fuel Economy Engineering Co. Phone numbers: Saint Paul, GArfield 5481; Minneapolis, NEstor 6396.

INDUSTRIAL Insulations

PRODUCTS OF

UNION ASBESTOS & RUBBER COMPANY

HARRY L. MAYES has joined the *HARLAN ENGINEERING CO.*, Lubbock, Tex., as a partner in the firm. He had been western Texas district representative for Minneapolis-Honeywell Regulator Co.

J. GORDON KING, formerly vice president of Owens-Illinois Glass Co., Toledo, and manager of glass container production, has been named general manager of the *KAY-LO DIV.* He joined the General Manufacturing Div. of the company in 1932.

P. C. FOOTE, formerly with the Milwaukee district sales office, is the new assistant manager of foreign sales for *CUTLER-HAMMER, INC.*, Milwaukee.

Appointment of a 34 man construction and civic development committee for 1952-53, headed by *NORMAN P. MASON*, treasurer, Wm. P. Proctor Co., North Chelmsford, Mass., has been announced by the *CHAMBER OF COMMERCE OF THE UNITED STATES.* The committee will study major factors affecting construction markets, government control of materials, credit and rents and the planning of private and public construction projects.

WILLIAM J. HENRY, formerly manager of the Cincinnati plant, has been named manager of the Homewood manufacturing and repair plant of *WESTINGHOUSE ELECTRIC CORP.*, Pittsburgh. He succeeds *JOHN H. THOMAS* who has been appointed manager of manufacturing at the firm's East Springfield, Mass., plant.

REYNOLD S. SMITH, JR., has been appointed to the newly created post of assistant to the president at *UNISTRUT PRODUCTS CO.*, Chicago.

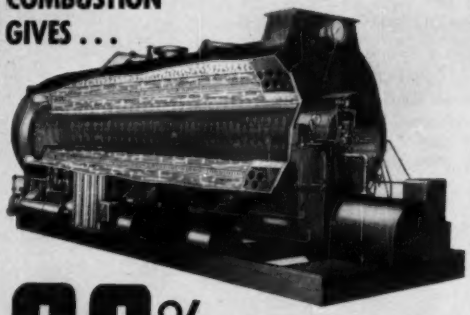
ROBERT E. CRYOR, vice president, *UNION ASBESTOS & RUBBER CO.*, Chicago, recently was put in charge of establishing and maintaining close relations with all governmental agencies and suppliers of materials. He relinquishes his duties as vice president in charge of manufacturing, Fibrous Products Div. *EMIL T. JOHNSON*, formerly director of engineering and research for that division, has been appointed its director of production and engineering.

A. P. ZIMMERMAN has joined *CARRIER CORP.*, Syracuse, as senior project engineer in the centrifugal department. Formerly, he was with Elliott Co., Jeannette, Pa.

A. O. SMITH CORP., Milwaukee, has appointed *J. H. BRINKER* as assistant executive in charge of distribution. Mr. Brinker formerly was general sales manager for the company's southwest district with headquarters at Houston. He will coordinate all distribution operations.

MAURICE A. STRAUB has been named assistant national sales manager of heating equipment for *RHEEM MFG. CO.*, New York. Prior to this he had been with Borg-Warner Corp.

ONLY CYCLONIC COMBUSTION GIVES . . .



66% MORE POWER
per sq. ft. of heating surface

By reducing heating surface requirements from 5 to just 3 sq. ft. per B.H.P., Cyclonic Combustion produces 66% more power per sq. ft.—saves up to ⅓ the space of conventional package steam generators. Cyclonic Combustion is the revolutionary new flame control used exclusively in Cyclotherm steam generators. Flame characteristics are controlled in a revolving spiral vortex traveling the full length of the furnace to insure maximum heat transfer without direct flame impingements or hot spots. The cyclonic action of the flame accounts for a 65 to 75% heat transfer within the main fire-tube. This high rate of heat transfer enables Cyclotherm 2 pass generators to maintain a guaranteed minimum efficiency of 80% for any steam requirement.

Cyclotherm steam generators with patented Cyclonic Combustion offer these additional features: Full power operation from a cold start in 15 to 20 minutes; Savings up to 50% on maintenance; Greater fuel savings; Boilers designed for oil or gas operation from 18 to 500 h.p., 15 to 200 psi operation pressure.

Proved superior in thousands of installations, Cyclotherm steam generators with new Cyclonic Combustion offer the most efficient and compact package steam generator on the market today. Find out more about Cyclotherm and Cyclonic Combustion—write today for a free illustrated folder.

The Cyclotherm meets all state requirements and is built in accordance with A.S.M.E. and National Board Standards and bears the label of Underwriters Laboratories, Inc.

CYCLOTHERM
STEAM GENERATORS

Cyclotherm Division U. S. Radiator Corp.
Dept. 26
Oswego, New York
Please send without obligation my copy of "All Your Questions Are Answered by Cyclotherm."

NAME_____
FIRM_____
ADDRESS_____
CITY ZONE STATE

HERBERT S. LEO has been appointed general manager of *UTILITY APPLIANCE CORP.*, Los Angeles. Mr. Leo, formerly director of sales for the Heating Div., now will be coordinator of the Heating, Cooling and Appliance Divs. *STANLEY SKAFTE*, formerly field engineer, will assume Mr. Leo's former duties.

FRANK N. SPELLER, D. Sc., corrosion specialist, has become an associate member of *MANAGEMENT COUNSELORS, INC.*, New York.

New publicity director for *PENN METAL CO., INC.* New York, is *JOHN D. COONEY*, who has been an associate editor for McGraw-Hill Publishing Co.

ROBERT A. McLAUGHLIN has been appointed director of sales for the new Fiber Glass Div., *PITTSBURGH PLATE GLASS CO.* Associated with the firm since 1940, he has been manager of the warehouse at Mineola, N.Y., for the past five years.

FORREST J. BEARD has been named advertising and sales promotion manager for *RAY OIL BURNER CO.*, San Francisco. Mr. Beard formerly was with Pabco Products, Inc.

WATER SERVICE LABORATORIES, INC., New York, has appointed *JAMES B. FULLMAN* as director of engineering sales, specializing in air conditioning. He had been associated with the A. M. Byers Co.

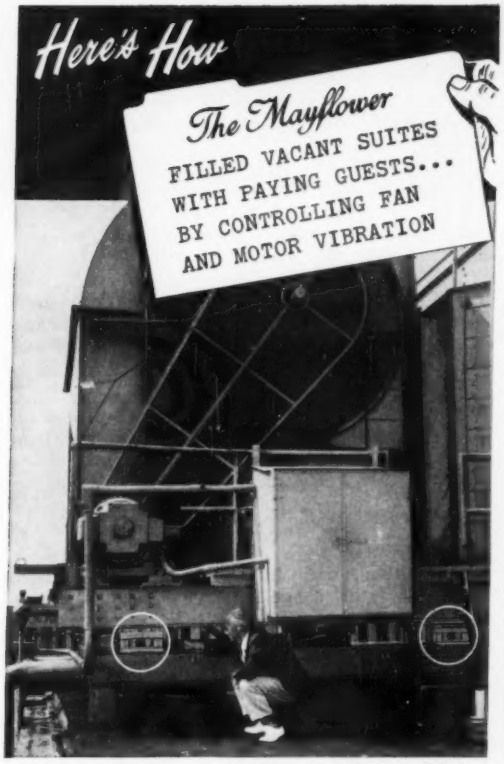
IAN K. MacGREGOR has been appointed director of manufacturing, Consolidated Ashcroft Hancock Div., *MANNING, MAXWELL & MOORE, INC.*, Stratford, Conn. Formerly vice president of Campbell, Wyant and Cannon, he will be in charge of manufacturing at the plants in Stratford; Watertown, Mass.; Tulsa; and Jersey City.

W. T. GOVE has been named by *MINNEAPOLIS-HONEYWELL REGULATOR CO.* as sales manager for the multiple-dwelling market in Minneapolis. He had been at the Boston office.

W. H. MOORE has been appointed factory sales engineer for the Aircraft Controls Div., *GENERAL CONTROLS CO.*, Glendale, Calif. Formerly he was a sales engineer for the Weatherhead Co., Cleveland.

CHARLES W. HAMMOND has been named to head the mechanical engineering department for *WALTER KIDDE NUCLEAR LABORATORIES*, New York. Formerly, he was with Jackson and Moreland, engineers.

Two appointments have been made in the sales and service departments of Dutton Boilers Div., *HAPMAN-DUTTON CO.*, Kalamazoo, Mich. *STANLEY J. PACHYN*, formerly assistant general sales manager of Combustion Control Corp., has been named general sales manager of the division. *HERMAN WILLIAMS*, recently in the field service department, has been named service manager and assistant sales manager.



13-Ton Fan and Motor on Roof of Mayflower Hotel, Washington, D. C.

Vibration from this huge cooling tower fan and motor made it impossible to rent suites on the floor below. Even water standing in drinking glasses showed a decided side-to-side movement.

That's all changed now.

As an executive of The Mayflower recently wrote, "Thanks to the recent installation of Korfund Steel Spring Vibro-Isolators, complaints regarding vibration have ceased."

When installed on roofs and upper floors, large fans, high pressure systems (including the centrifugal compressors), and reciprocating compressors require special consideration. It costs surprisingly little to prevent serious vibration problems with Korfund Vibration Control. There are also low cost Korfund mountings for less critical installations such as centrifugal pumps, most ventilating fans, and for basement and factory installations.

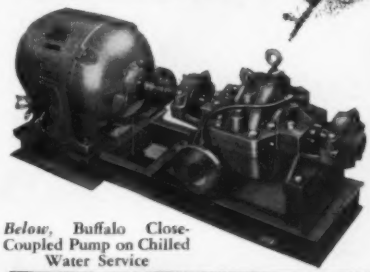
The Selector Chart in Bulletin G-104 gives recommendations for isolation of most equipment for both critical and normal conditions. See Sweet's Architectural or Engineering Files, or write for your free copy today. We'll also submit specific recommendations, without obligation. Just contact us, or the Korfund representative you'll find in most principal cities. A half century of experience is at your disposal.

KORFUND VIBRATION CONTROL — SPRINGS — RUBBER — CORK

THE KORFUND COMPANY, INC.

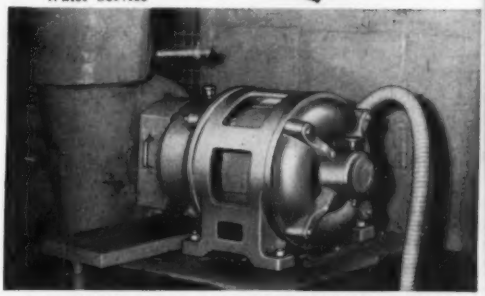
41-01F Thirty Second Place, Long Island City 1, N. Y.
In Canada: 510 Canal Bank, Ville St. Pierre, Montreal

Haven't Had A Minute's Trouble Since We Put In "Buffalo" PUMPS



Left, Buffalo Class "RR" Pump for Boiler Feed and Other Clear Water Service

Below, Buffalo Close-Coupled Pump on Chilled Water Service



From on-the-job reports, we know that "Buffalo" Pumps are piling up savings in just this way. That's because they're built ruggedly—with extra heavy impellers, shafts, bearings and casings—all parts readily accessible for easy servicing. And inherent efficiency in every "Buffalo" Pump adds power savings to your maintenance savings. Best of all, in the "Buffalo" line, you can match the pump to your service and your conditions—there's a "Buffalo" Pump for almost every capacity, liquid and head required in industry. And each passes a thorough load test under specified conditions before shipment.

WRITE

for these free "Buffalo" bulletins! No. 955-Now Type "SL" Pumps, No. 980-B on Type "RR" Pumps and No. 975-B on "Buffalo" Close-Coupled Pumps.

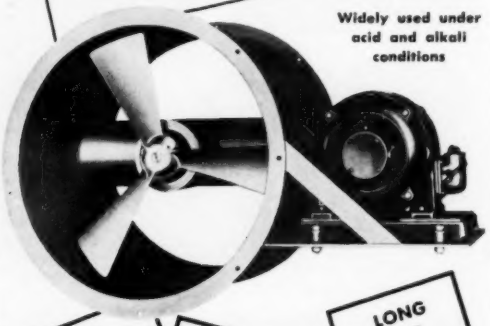
"Buffalo"
BUFFALO PUMPS, INC.
171 MORTIMER STREET BUFFALO, N. Y.

Subsidiary of Buffalo Forge Company

Canada Pumps, Ltd., Kitchener, Ont. Sales Representatives in all Principal Cities

A BETTER CENTRIFUGAL PUMP FOR EVERY LIQUID

EXPEL GASES, EXPLOSIVE FUMES AND DUSTS
with Propellair "CS" Fans



Widely used under acid and alkali conditions

HIGH EFFICIENCY
LOW MAINTENANCE
LONG LIFE

■ Propellair's "CS" Fan is a rugged, heavy-duty unit for duct installation. The cast aluminum airfoil propeller is housed in a heavy-gauge steel duct section with steel belt guard and internal bearing support. All-welded construction. *R&M All-Weather Motor* located outside airstream. Sizes from 20" to 60", with certified air deliveries of 3750 to 85,000 c.f.m. Also available with corrosion and abrasion-resisting finishes and with ventilated bearings for high temperatures.

Simplified Installation
Propellair "CS" Fans are built to fit standard duct sizes without the need of elbows. The fan drum has front and rear flanges drilled for easy mounting into duct system.

Write for Bulletin 3082-H. Our engineers will be glad to give you free advice on any ventilating problem.

PROPELLAIR®
DIVISION OF ROBBINS & MYERS, INC
SPRINGFIELD · OHIO

Man Cooler | Direct Drive | Sky-Blast | Vaneaxial | Extended Shaft

A. J. LACOCK has been appointed director of purchases, *FOSTER WHEELER CORP.*, New York. Most recently with Lukens Steel Corp., he replaces *F. J. SWENSON* who has been with the company since 1921 and will remain active as special assistant on purchasing problems.

ROBERT W. AYLING has joined the engineering staff of the *BRUNNER MFG. CO.*, Utica, N.Y., as a development engineer. For the past five years, he has been with the Carrier Corp. as a receiver and compressor engineer.

J. C. EVANS, with the company since 1935, has been appointed assistant controller of *WAGNER ELECTRIC CORP.*, St. Louis. He replaces *C. J. FALKENRATH* who died recently.

FLEXIBLE TUBING CORP., Guilford, Conn., has appointed *ROBERT H. POULTON* as representative, technical sales. He joined the company last year.

IN THE TERRITORIES . . .

For *BRUNNER MFG. CO.*, Utica, N. Y. — *A. L. HALDEMAN* is district manager in the Cleveland territory, which includes the northern half of Ohio, western Pennsylvania, northwestern section of West Virginia and the lower part of Michigan. He succeeds *STEVE HANNA* who is retiring after 16 years with the company.

For *CRANE CO.*, Chicago — *CHARLES A. WARDEN* is manager of the San Francisco branch, succeeding *M J. BURRESS*, retired. *GEORGE H. McMURDO*, former manager of the Salinas branch, succeeds Mr. Warden as sales manager and assistant manager at the San Francisco office.

For *FAGEOL HEAT MACHINE CO.*, Detroit — *J. I. GAISFORD* is handling distribution and sales in Michigan, Indiana and western Ohio, with headquarters in Huntington, Ind.

For *STEVENS MFG. CO., INC.*, Mansfield, Ohio — *PAUL A. DAHLEN* is application engineer to cover western Pennsylvania, Ohio, and Kentucky, with headquarters at Mansfield.

For *CONNECTICUT HEAT & FUEL CO.*, New Haven — *LAWRENCE R. BABCOCK* is sales engineer throughout Connecticut. For the past 25 years, he has been associated with the Petroleum Heat and Power Co., of Stamford, Conn.

For *ACRO MFG. CO.*, Columbus — *JOHN PHILLIPS* is sales engineer in the New England territory with headquarters in Hingham, Mass. He had been district representative in the sales department of the Boston Edison Co.

For *CAPEWELL MFG. CO.*, Hartford, Conn. — *WILLIAM E. McCULLOUGH* is tri-state sales engineer for western Pennsylvania, eastern Ohio and northern West Virginia. He succeeds *C. D. LIBBY*, who was with the company for 26 years.

Hospital in Montgomery, Alabama, equipped with No. 5 Lo-BLAST Burner

FOR EVERY TYPE OF BUILDING

LO-BLAST

IS THE GAS HEATING "BUY"

From coast to coast, you'll find Lo-BLAST Power-type Conversion Gas Burners heating buildings ranging from small residences to entire villages heated from a central plant. Preference for Lo-BLAST springs from proved efficiency, safety, durability . . . *operating records show an average saving of* 10%!

Compare these operating and construction features:

Power Burner Design. Perfect combustion, regardless of draft—a proved fuel saver. Safe and efficient for down-draft units.

Simple to Install. Every Lo-BLAST is factory tested on gas and shipped assembled.

Safe Operation. Lo-BLAST comes equipped with dependable, foolproof safetys.

Soft, Quiet Flame. No "pop" when the Lo-BLAST goes on or off—burns so smoothly you can hardly tell it's running.

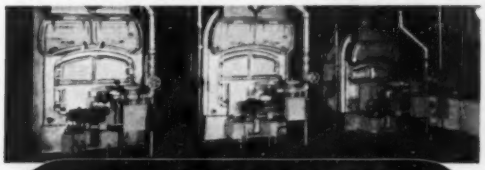
Easy to Service. All parts are accessible—nothing in the firebox but the fire. Simplicity of design and durable construction reduce service to a minimum.

Long Lasting. Many Lo-BLAST Burners have been in operation 15 years without service.

Complete Capacity Range. Units available from 70,000 to 20,000,000 BTU input.

The "mighty-mite" of conversion gas burners—capacities from 70,000 to 500,000 BTU. All the famous design features of the larger Lo-BLAST packed into a low-cost unit for residential use. Write for descriptive literature.

This battery of Lo-BLAST Burners handles 11,000 sq. ft. of steam radiation plus 10,000 gallons of hot water per day.



MID-CONTINENT
METAL PRODUCTS CO.
1960 N. Clybourn Ave., Chicago 14, Ill.

DESIGNED for FLEXIBILITY

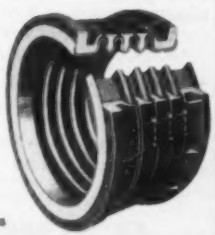
Badger Expansion Joints set the standards in the field of expansion joints — engineered for long life and designed for flexibility. For protection from damage to equipment by absorbing the expansion and contraction in piping due to temperature changes, specify Badger Expansion Joints.

D-F S-E Directed-Flexing Self-Equalizing: an exclusive feature of Badger Expansion Joints. The flexing of the corrugations is progressively directed over each segment of each of the all-curve corrugations by correspondingly shaped self-equalizing rings. Localized stresses are eliminated insuring a more flexible longer lasting joint.

Buy Badger Joints and you get flexibility, D-F S-E and these features:

- Packless . . . pressure-tight single tube—requires no maintenance
- Compact . . . approximately the size of flanged fitting
- Special forming . . . no structure-weakening stresses
- Controlled heat treating . . . assures long life
- Wide range of traverse — pressure — temperature

Fabricated from deoxidized copper, stainless steel and special alloys to meet various operating conditions.



BADGER MANUFACTURING COMPANY

Original and Sole Manufacturer of Badger Expansion Joints

230 BENT STREET • CAMBRIDGE • MASS.

For *OHIO ELECTRIC MFG. CO.*, Cleveland — *MICHAEL FABBRI* is New England area electric motor sales engineer. Formerly sales representative for Torrington Mfg. Co. in the same area, he will make his headquarters in Litchfield, Conn.

For *DIAMOND IRON WORKS, INC.*, Minneapolis — *BLUEFIELD HARDWARE CO.*, Bluefield, W. Va., is distributor of "Stokol" coal burning equipment in western West Virginia.

For *GUSTIN-BACON MFG. CO.*, Kansas City, Mo. — *EDWARD A. McCABE* is manager of the New York division, having charge of insulation, industrial and railroad division sales in New England, New York, New Jersey, Pennsylvania and Delaware.

For *JACKSON & CHURCH CO.*, Saginaw, Mich. — *W. H. TONNER* is factory representative in metropolitan New York and northern New Jersey. Most recently, he was assistant sales manager of Auer Register Co., Cleveland.

For *MINNEAPOLIS-HONEYWELL REGULATOR CO.*, Minneapolis — three new sales managers: *TOD S. CARLEY*, formerly southwestern regional manager, is manager of the midwestern region with headquarters in Chicago; *FREDERICK C. BRANDT* succeeds Mr. Carley as head of the southwestern region; *J. M. DOUGLAS* is valve sales manager for the central region with headquarters at the Cleveland branch office.

For *KRITZER RADIANT COILS, INC.*, Chicago—new sales representatives: *HARRY MATHER* in the Pennsylvania territory, with offices at 250 North 11th St., Philadelphia; and *CHARLES M. MARTIN*, 780 Natoma St., San Francisco, for that city and the surrounding territory.

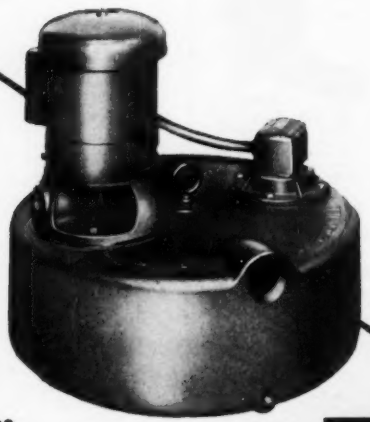
For *L. J. MUELLER FURNACE CO.*, Milwaukee — *L. E. LEWIS* is northern district sales representative. His territory includes North and South Dakota, Minnesota, upper Michigan and the northern portion of Wisconsin with headquarters in St. Paul. He succeeds *GEORGE M. HASE*, recalled to the home office for a special assignment. *GEORGE O. WEBB* is sales representative in Washington and Oregon, with headquarters in Seattle. *D. W. KARR* is sales representative for North Carolina, most of South Carolina and Virginia and a portion of southern West Virginia.

For *CENTURY ENGINEERING CORP.*, Cedar Rapids — two new district sales managers: *M. F. KEIDERLING* will direct sales in the Kansas City-Omaha district which includes western Iowa and Missouri, Kansas and Nebraska. *J. G. HASTIE* is sales manager in eastern and central Iowa and western Illinois.

For *TIMKEN SILENT AUTOMATIC DIV.*, Timken-Detroit Axle Co., Jackson, Mich. — *LLOYD I. BROWN* is field service representative in central and eastern Canada. His territory includes Ontario, Quebec, New Brunswick and Nova Scotia.

LOW PRESSURE SYSTEM
Condensate Pumps

weil Dependable PUMPS



weil TVC Pumps
Low Return Connection
Low Speed, Long Life
Cast Iron Receiver
Single or Duplex
Low Water Line
Capacities 500 to 10,000 Sq. Ft. E.D.R.

For Single Units
Dimensions: 10 gal. receiver
Diameter—21"
Height of return above floor—6⅞"

For Single or Duplex Units
Dimensions: 15 gal. receiver
Diameter—25½"
Height of return above floor—7 3/16"

Fig. TVC 126

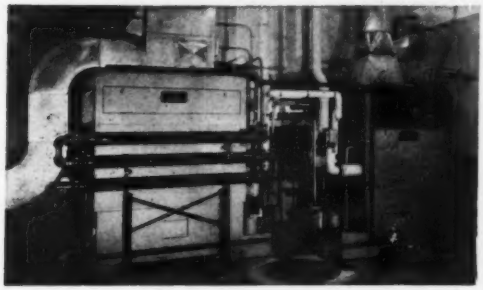
ASK FOR BULLETIN TVC 300

weil PUMP CO.
1530 N. FREMONT ST. CHICAGO 22, ILL.

Available from JOBBERS' STOCKS

Niagara's HYGROL DRIES AIR BEST

with exact moisture content



NIAGARA CONTROLLED HUMIDITY AIR CONDITIONING

This method removes moisture from air by contact with a liquid in a small spray chamber. The liquid spray contact temperature and the absorbent concentration, factors that are easily and positively controlled, determine exactly the amount of moisture remaining in the leaving air. Heating or cooling is done as a separate function.

The Niagara's Controlled Humidity Method using HYGROL moisture-absorbent liquid is

Best and most effective because . . . it removes moisture as a separate function from cooling or heating and so gives a precise result constantly and always. Niagara machines using liquid contact means of drying air have given over 20 years of service.

Most reliable because . . . the absorbent is continuously reconcentrated automatically. No moisture-sensitive instruments are required to control your conditions.

Most flexible because . . . you can obtain any condition at will and hold it as long as you wish in either continuous production, testing or storage.

Easiest to take care of because . . . the apparatus is simple, parts are accessible, controls are trustworthy.

Most compact, taking less space for installation.

Inexpensive to operate because . . . no re-heat is needed to obtain the relative humidity you wish in normal temperature ranges and frequently no refrigeration is used to remove moisture.

The cleanest because . . . no solids, salts or solutions of solids are used and there are no corrosive or reactive substances.

For complete information write

NIAGARA BLOWER COMPANY

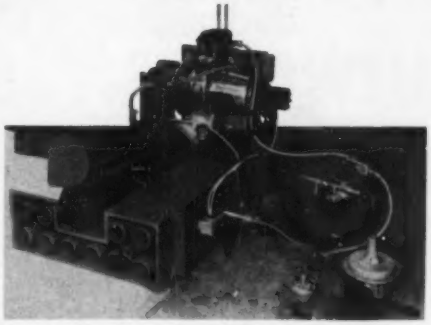
Over 35 Years of Service in Industrial Air Engineering

Dept. HP, 405 Lexington Ave. New York 17, N. Y.

Sales Engineers in Principal Cities of U. S. and Canada

WEBSTER DUONETIC*

for Dual Fuel Firing



The WEBSTER DUONETIC* now offers unsurpassed economy, efficiency and trouble-free operation in the combination oil and gas firing equipment field. Never before have both fuels been burned so well so simply.

You can rely on the usual WEBSTER quality to provide you with the best.

Both burners employ electric ignition; constant electric ignition on the oil burner, and electric ignition for the gas burner safety pilot.

WEBSTER KINETIC* BURNER

For Low Pressure Gas

The Webster Kinetic consists of a multiplicity of full venturi mixers with flame retention nozzles. These are assembled in a metal casing complete with pilot and louver. It may be used with natural, mixed or liquefied petroleum gases. Standby oil burners may be used when desired.

As a multiple head assembly it is available in 25 standard sizes of from 4 heads to 48 heads, and can be supplied in any size or shape. Natural gas input ratings from 560,000 Btu/hr to 6,720,000 Btu/hr at 4" wc.

For complete information request Series 88 Bulletins.

* TRADEMARK

The WEBSTER ENGINEERING COMPANY

TULSA, OKLAHOMA

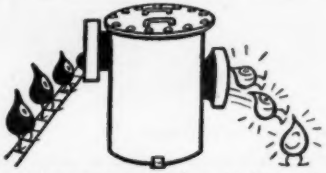
Division of SURFACE COMBUSTION CORPORATION, Toledo, Ohio

AIR-MAZING FACTS

BY O. SOGLOW

WHEN THE SUN TURNED BLUE! On September 26, 1950, canny Scotsmen got a look at something uncanny. The sun had turned blue! Smoke blown across the Atlantic from forest fires in Canada was believed to have caused the phenomenon.

GAS GUARD! Piping natural gas over long distances demands dependable performance from pumping engines. Air-Maze oil-bath filters on engine air intakes remove dirt and dust from the air, guard against breakdowns, keep engines—and gas—going dependably.



LAUNDRY FOR LUBRICANTS! Air-Maze full-flow type oil filters for stationary diesel engines remove dirt and sludge from crankcase lubricating oil, greatly reducing wear and abrasion on moving parts. Filters are all-metal. Cleaning restores original characteristics.

WHETHER YOU BUILD OR USE engines, compressors, air-conditioning and ventilating equipment, or *any device using air or liquids* — the chances are there is an Air-Maze filter *engineered* to serve you better. Representatives in all principal cities, or write Air-Maze Corporation, Cleveland 5, Ohio.

AIR-MAZE

The Filter Engineers

AIR FILTERS
SILENCERS
SPARK ARRESTERS

LIQUID FILTERS
OIL SEPARATORS
GREASE FILTERS

MEETINGS & CONVENTIONS

IBR SCHOOL OF MODERN HEATING — October 6, 7, 13, 14, 20 and 21, Westchester Lighting Co., White Plains, N.Y.; October 9, 10, 16, 17, 23 and 24, YMCA — Bedford Branch, 1121 Bedford Place, Brooklyn; October 28 to 30, Wilmington, Del.; November 5 to 7, Johnstown, Pa. Sponsored by the Institute of Boiler and Radiator Manufacturers, 60 E. 42nd St., New York, 17. This is a short course providing instruction in the design and installation of hot water and steam heating systems.

AMERICAN WELDING SOCIETY, 33 W. 39th St., New York 18 — 33rd national meeting, week of October 19, Bellevue-Stratford Hotel, Philadelphia.

AMERICAN INSTITUTE OF WHOLESALE PLUMBING AND HEATING SUPPLY ASSOCIATIONS, INC.— First national convention, October 19 to 22, Chalfonte-Haddon Hall Hotel, Atlantic City, N.J. For further information write G. T. Underwood, executive secretary, Room 402, Albee Bldg., 15th and G Sts., Washington, D.C.

40th NATIONAL SAFETY CONGRESS AND EXPOSITION — October 20 to 24, Chicago. Sponsored by the National Safety Council, 425 N. Michigan Ave., Chicago.

AMERICAN GAS ASSOCIATION, 420 Lexington Ave., New York 17 — 34th annual convention, October 27 to 30, Atlantic City, N.J. An exhibit by the Gas Appliance Manufacturers Association will be held concurrently.

COURSE IN ARCHITECTURAL PLANNING FOR HEATING AND AIR CONDITIONING OF SMALL BUILDINGS — October 29 to 31, Urbana, Ill. Sponsored by departments of mechanical engineering and architecture, University of Illinois, in cooperation with the extension division. Further information may be obtained from Robert K. Newton, Supervisor, Engineering Extension, University of Illinois, 715 S. Wright St., Champaign.

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS, 40 W. 40th St., New York 18 — 48th annual meeting, November 30 to December 3, Hotel Commodore, New York. Symposiums will be conducted on commercial and industrial coil defrosting, insulation and room air conditioners. One session will cover automobile air conditioning. On December 1 the society will hold a joint meeting with the American Society of Mechanical Engineers.

20th NATIONAL EXPOSITION OF POWER AND MECHANICAL ENGINEERING — December 1 to 6, Grand Central Palace, New York. Management of the show is the International Exposition Co., Grand Central Palace, New York 17. It is held under the auspices of the American Society of Mechanical Engineers, whose annual meeting will be in session during the same week.

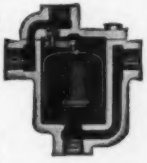
NATIONAL WARM AIR HEATING AND AIR CONDITIONING ASSOCIATION, 145 Public Square, Cleve-

you can lose plenty if you are *UNDER-TRAPPED*

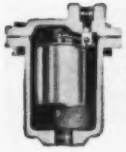
It doesn't pay to skimp on traps . . . especially steam traps. Water and air in steam lines reduces effective temperatures, wastes fuel and adds to maintenance costs.

Clark Steam Traps have proven their outstanding drainage efficiency over many years of use in thousands of plants. Now, with the new Duo-Step double-drainage capacity feature, they can handle twice the condensate of ordinary traps. It will pay you to see your Clark representative or write us for further information.

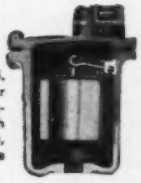
QUICK CLEANING STRAINERS. Remove dirt, scale and grit from steam, fluid and gas lines. Sizes ½" to 3" I.P.S.



SERIES "60" INVERTED BUCKET TRAP. Choice of horizontal or vertical inlet or outlet. For pressures up to 150 P.S.I. "Clark-loy" guided disc and seat.



CLARK "701"-D (DUO-STEP) TRAP. A forged steel trap for pressures up to 500 P.S.I. and temperatures of 750°F. Equipped with "double-drainage" Duo-Step leverage and venting, "Clark-loy" seats and discs. Pipe sizes ½" or ¾".



SERIES "80"-D (DUO-STEP) TRAPS. Cast semi-steel construction for pressures up to 250 P.S.I. and temperatures to 450°F. Equipped with Duo-Step Leverage and Venting, "Clark-loy" seats and discs. Pipe sizes from ½" to 2".

THE Clark MANUFACTURING COMPANY

THE HOME OF DUO STEP LEVERAGE

1830 E. 38th St. • CLEVELAND 14, OHIO

Speed up Assembly!

Switch to BLACK & DECKER POWER!

BLACK & DECKER HOLGUN* drills holes to ¼" diam. in steel, to ½" diam. in hardwood. Perfectly balanced, light in weight, compact, easy to handle, accurate. Famous "Pistol Grip and Trigger Switch."

BLACK & DECKER SCRUGUN* drives machine screws and nuts to ¼", self-tapping screws to #12, wood screws to #10 x 2". Positive or adjustable clutch available. Same design features as B&D HOLGUN!

SEE YOUR NEARBY B&D DISTRIBUTOR for demonstrations and full details on this famous team of assembly tools. They'll help your men turn out more work, with less fatigue and less spoilage. And you have nearly 50 other B&D Drill and Screw Driver models to choose from to fit your needs on heavier work! Write for free catalog to: THE BLACK & DECKER MFG. Co., 640 Pennsylvania Ave., Towson 4, Md.

*Trade Mark Reg. U. S. Pat. Off.

SHEARS

SANDERS

BENCH GRINDERS

HAMMERS

LEADING DISTRIBUTORS EVERYWHERE SELL

B&D Black & Decker PORTABLE ELECTRIC TOOLS

land 14 — 39th annual convention, December 3 and 4, Sheraton Gibson Hotel, Cincinnati.

10th REFRIGERATION AND AIR CONDITIONING EDUCATIONAL EXHIBIT AND CONFERENCE — December 5 to 7, Miami. Sponsored by the Refrigeration Equipment Manufacturers Association, 1346 Connecticut Ave., N.W., Washington 6, D. C. Annual meetings of the Refrigeration Service Engineers Society and the Refrigeration and Air Conditioning Contractors Association will be held in Miami at the same time, followed by a joint meeting of the manufacturers and wholesalers on December 8 and 9, Hollywood Beach, Fla.

PLANT MAINTENANCE CONFERENCE AND SHOW — January 19 to 22, 1953, Public Auditorium, Cleveland. Management of the show is Clapp & Poliak, Inc., 341 Madison Ave., New York 17.

NATIONAL HEATING WHOLESALERS ASSOCIATION, INC., 637 Union Commerce Bldg., Cleveland 14 — The annual meeting, January 26 to 28, Congress Hotel, Chicago.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, 62 Worth St., New York 13 — 59th annual meeting, January 26 to 29, Conrad Hilton Hotel, Chicago.

11th INTERNATIONAL HEATING & VENTILATING EXPOSITION — THE AIR CONDITIONING EXPOSITION — January 26 to 30, 1953, International Amphitheatre, Chicago. Held under the auspices of The American Society of Heating and Ventilating Engineers. Address inquiries to the exposition management, International Exposition Co., Inc., Grand Central Palace, New York 17.

NATIONAL ASSOCIATION OF CORROSION ENGINEERS, 1061 M & M Bldg., Houston 2. — Conference and exhibition, March 16 to 20.

Testing and Rating Code for Low Pressure Boilers

The fifth edition of *IBR Testing and Rating Code for Low Pressure Cast Iron Heating Boilers* has been published by the Institute of Boiler and Radiator Manufacturers. All changes which have been adopted by members since the publication of the fourth edition in 1947 have been included plus a description of the procedure to be followed by testing laboratories to determine IBR ratings for cast iron boilers. Two major changes appear in the new edition. The IBR rating table now has two parts — hand-fired boilers and automatically-fired boilers. The second change is the addition of a new part on testing of conversion gas-fired boilers.

The Code is divided into five parts: (1) rating of boilers; (2) testing of hand-fired boilers; (3) testing of oil-fired boilers; (4) testing of conversion gas-fired boilers, and (5) procedure of obtaining IBR ratings.

The publication may be obtained from the Institute of Boiler and Radiator Manufacturers, 60 E. 42nd St., New York 17, at $5.00 a copy.

FOR QUIET, EFFICIENT OPERATION

write Peerless into your specifications

DIRECT DRIVE UTILITY BLOWERS

For general ventilation and exhaust such as in boiler rooms, restaurants, wash rooms, etc. Motors available for all types of currents. Housings constructed of 16-gauge steel.

BELT DRIVE UTILITY BLOWERS

Sturdy arc-welded housings and frames. Motor pulley adjustable for variety of speeds. Weatherproof covers available. Housings convertible for various exhaust angles.

DIRECT DRIVE EXHAUST FANS

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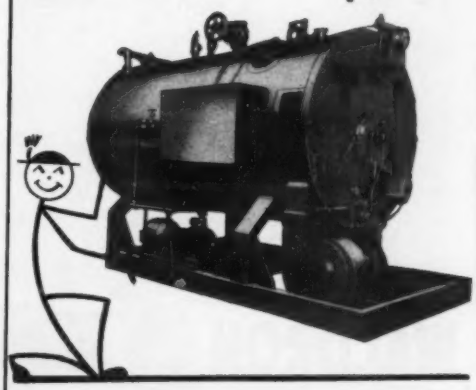

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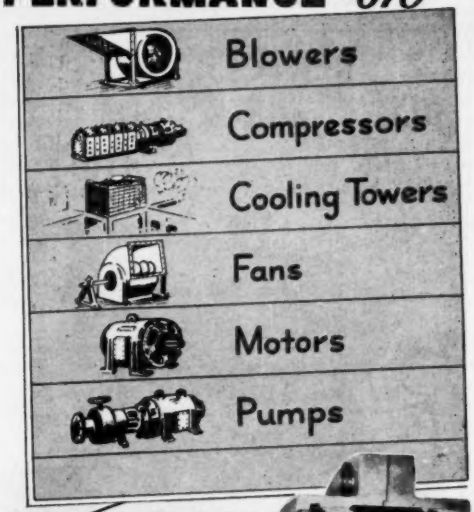

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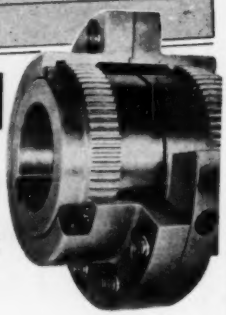

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Thermal Conditions in Ships in Tropical Waters

Because of the prevalence of high air temperatures and humidity within compartments in ships in tropical waters during World War II, the Royal Naval Personnel Research Committee in England was asked to study and define the upper levels of warmth which were compatible with health and efficiency of personnel. The findings were presented in a paper, *Prediction of Thermal Conditions in H. M. Ships in Tropical Waters,* by J. A. B. Gray and F. E. Smith. It was found that 80 F was the upper desirable limit and 86 F, the upper allowable limit. Other conclusions presented in the paper are: the difference between total heat content of the air within a compartment and that of the external air is shown to be independent of the temperature and humidity of the outside air provided the ventilation is unchanged; compartment wet-bulb temperature can be predicted by adding heat gain to a given external total heat content and converting the answer to wet-bulb temperature. A nomogram is presented for easy prediction of effective temperature on mess-decks.

This paper was presented at a meeting of the [British] Institution of Naval Architects.

Program for Instrument Mechanic Training

Industrial Instrument Training Course Outline has been released by the national office of the Instrument Society of America. The publication covers such aspects of a program as selection of mechanic personnel, instructor's suggestions, physical equipment, reference books and films, and training material has been outlined according to subject. The outline was collected and edited by 16 industrial instrument engineers and maintenance supervisors who are members of the sub-committee on instrument mechanic training.

It offers programs covering fundamentals of mechanics and electricity, theory and practice in operation and maintenance of electrical, mechanical, pneumatic, hydraulic, and electronic instruments. Instruments for measuring and controlling such variables as temperature, pressure, flow, and level are covered. Automatic control instruments, valves, time cycle instruments, combustion control and other subjects also are included.

This 60 page booklet is available from the society, 1319 Allegheny Ave., Pittsburgh 33, at 75 cents a copy to members, $1.50 to non-members.

Heat Transfer Through Insulating Materials

The *Analysis of Heat Transfer through Thermal Insulating Materials* is graphically presented in an article in the August "Engineering Journal" published by the Engineering Institute of Canada. A detailed report is given to show the results of laboratory tests to determine the relative effectiveness of various types of insulating materials as barriers to heat transmission. The influence of radiation and convection on heat transmission through walls insulated with light fibrous materials is also shown.

The paper was presented at the Heat-Transfer Discussions at London, England, September 1951. The magazine is available from the Institute, 2050 Mansfield St., Montreal, Quebec, at 75 cents a copy.

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Alnor VELOMETER
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Ask The W. B. Connor Engineering Corporation how to balance an installation equipped with their Kno-Draft diffusers, and they'll tell you . . . measure the *actual* air delivery—precisely and quickly—with an Alnor Velometer.

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For your convenience in obtaining copies of these bulletins, see coupon on page 195. If you write direct to the manufacturer, describe fully what you want, as the number given first in each item is for use only when sending requests to Heating, Piping & Air Conditioning.

Acoustic Panels

HPAC 101—Booklet describes new standardized acoustic panels, and their use in silencing machinery and in other applications. [Manufacturer: Industrial Acoustics Co. Inc., 333 Jackson Ave., New York 54.]

Air Compressors

HPAC 102—Specification sheet H-605-B2 contains a description of "Monobloc" air compressors with capacities of 2.6 to 5.0 cfm and up to 150 lb pressure per sq in. Typical applications include operation of pneumatic controls and tools, pressure spraying, and other small capacity uses. For this sheet, write directly to the manufacturer on company letterhead. [Manufacturer: Worthington Corporation, Harrison, N. J.]

Aircraft Heating

HPAC 103—Booklet, *Heat in Harness* discusses gas combustion and the technology and engineering of aircraft heating equipment. [Manufacturer: Surface Combustion Corp., Toledo 1, Ohio.]

Alloy Castings in Industry

HPAC 104—Booklet (48 pages) offers information on heat resistant and corrosion resistant alloy castings. Typical compositions with their applications, limitations and specific types of service are discussed. [Manufacturer: International Nickel Co., Inc., Dept. EZ, 67 Wall St., New York 5.]

Automatic Controls for Refrigeration

HPAC 105—Catalog 54-R gives specifications and dimensions for automatic controls used in refrigeration and air conditioning. Covered are hydramotor valves, high or low pressure control, dual high low pressure control, refrigeration temperature control, humidity control and a thermostatic expansion valve. Available by request on company letterhead. [Manufacturer: General Controls Co., 801 Allen Ave., Glendale 1, Calif.]

Boiler Tube Corrosion

HPAC 106—Bulletin TR-514 discusses corrosion as the largest single cause for the replacement of boiler tubes in low pressure boilers. Reprinted from the March 1952 issue of *Heating, Piping & Air Conditioning*, the article shows the various types and causes of corrosion and offers a number of general rules to follow to get maximum service life for boiler tubes. [Manufacturer: Tubular Products Div., Babcock & Wilcox Co., Beaver Falls, Pa.]

Boiler Tubes

HPAC 107—Bulletin TB-331A contains data on production of steam for heating, power and processing. In-

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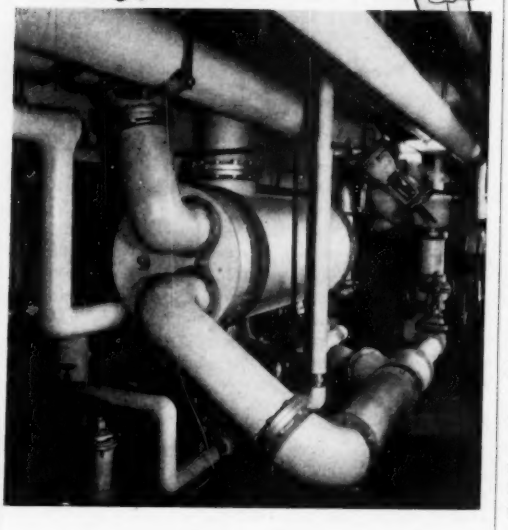

Yes, it pays to consider Whitlock Convertors for hot water heating systems in industrial plants, commercial buildings, and in communities supplied by district steam heating systems. Here's hot water heat that's easy to control, easy to operate . . . and that requires a minimum of plant space. Whitlock Type R U-tube Convertors are ready-built for both gravity and forced circulation hot water heating systems. We offer you a wide range of standard heater sizes plus the benefit of our years of engineering experience in applying Convertors to specific operating conditions.

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cluded are tables of maximum allowable working pressures of electric-resistance-welded steel boiler tubes for fire-tube and water-tube boilers and weights per ft for various tubing sizes. [Manufacturer: Babcock & Wilcox Co., Tubular Products Div., Welded Tube Works, Alliance, Ohio.]

Centrifugal Pumps

HPAC 108—Bulletin 3-8000 describes two vertical, centrifugal, wet-pit pumps; a heavy duty bilge pump for handling solids-free liquids and drainage; and a screenless sewage ejector, constructed to handle sewage and solids-carrying liquid. Also described is a new lubricating system for the pump bearing. [Manufacturer: Yeomans Brothers Co., 2000-5 N. Ruby St., Melrose Park, Ill.]

Centrifugal Refrigeration Drives

HPAC 109—No. 36 of the quarterly publication, *E-M Synchronizer*, deals with the application of a-c motors to centrifugal refrigeration compressors. Lead articles discuss refrigerant characteristics, compressor capacity control, motor characteristics and motor control. Other articles include *The Line Diagram* and *How to Select Control for Wound-Rotor Motors*. [Publisher: Electric Machinery Mfg. Co., 1331 Tyler St., N. E., Minneapolis 13.]

Comparator Slide Rule

HPAC 110—A 9-in. welding electrode comparator slide rule (37B) for electrode comparison. [Manufacturer: General Electric Co., Schenectady 5, N. Y. Available from the company's welding distributors.]

Compressors

HPAC 111—Bulletin L-676-B1 features heavy duty package type "Feather Valve" compressors from 75 to 350 hp. The bulletin is illustrated. [Manufacturer: Worthington Corp., Harrison and Worthington Streets, Harrison, N. J.]

Control Elements

HPAC 112—Technical bulletin, *New Techniques in Control Valve Design*, offers a review of pneumatic final control elements. [Manufacturer: Conoflow Corp., 2100 Arch Street, Philadelphia 3.]

Convector Installations

HPAC 113—Catalog on "Air Flow" convectors contains information for calculation and roughing-in of convector installations including ratings, dimensions and other technical data. [Manufacturer: United States Radiator Corporation, 300 Buhl Building, Detroit 26.]

Convector Ratings

HPAC 114—Catalog 601 includes information on "Art" convectors and the new and approved NBS convector ratings. Free standing and semi-recessed steel enclosures for convectors are also described and illustrated. [Manufacturer: National Radiator Co., Johnstown, Pa.]

Covers for Finned Radiation

HPAC 115—Bulletin 720 contains specifications for flat and slant top covers for finned radiation. Included

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are dimensions and installation instructions. [Manufacturer: Bush Mfg. Co., 179 South St., West Hartford 10, Conn.]

Dust Filters

HPAC 116—Bulletin No. 102 gives engineering and application data for "Dynaclone" dust filter for venting continuous dust creating operations. [Manufacturer: W. W. Sly Mfg. Co., 4700 Train Ave., Cleveland 2.]

Flanged and Dished Heads

HPAC 117—Bulletin lists sizes of ASME and standard types of flanged and dished heads for pressure vessels, boilers, tanks, etc. [Publisher: Joseph T. Ryerson & Son, Inc., Box 8000-A, Chicago 80.]

Flexible Metal Hose

HPAC 118—Bulletin CMH-115R gives specifications on RT-6 and RT-8 "Rex-Tube" flexible metal hose, used for ventilating ducting and refrigeration tubing. [Manufacturer: Flexonics Corp., 1396 S. Third Ave., Maywood, Ill.]

High Pressure Air Diffusers

HPAC 119—Bulletin K-29 illustrates and describes several types of high pressure diffusers. These units are made to handle static pressures ranging from 1 to 4 in. water gage, duct velocities up to 3000 fpm and 25 deg temperature differentials, the manufacturer states. [Manufacturer: W. B. Connor Engineering Corp., Shelter Rock Lane, Danbury, Conn.]

Industrial Heaters

HPAC 120—Catalog NGC-10-52 lists specifications and dimensions of all models of "Thermobloc" gas or oil-fired industrial heaters. Various models (suspended, portable, etc.) are illustrated. [Manufacturer: Prat-Daniel Corp., 2 Meadow St., South Norwalk, Conn.]

Industrial Insulation Products

HPAC 121—Catalog describes insulating materials covering a temperature range of −150 to 1800 F. Insulating cement, block, blanket, felt and pipe covering are some of the products shown in the 20-page booklet. Also given are conductivity and heat loss charts. [Manufacturer: Baldwin-Hill Co., 1026 Breunig Ave., Trenton, N.J.]

Insulated Thermocouple Wires

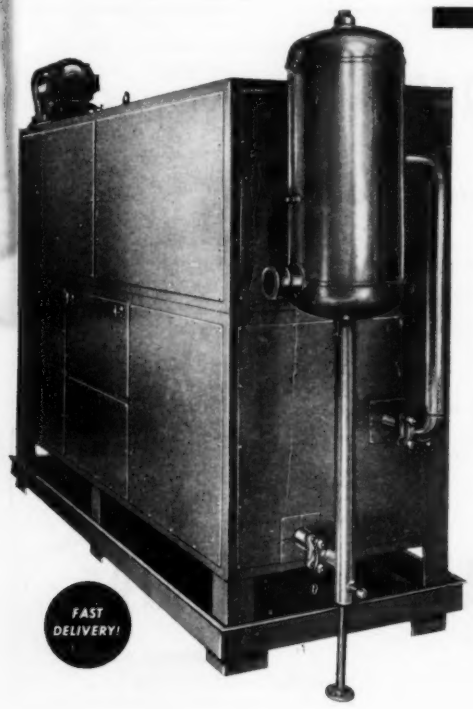
HPAC 122—Bulletin 5600 introduces three new thermocouple wires for temperatures −20 to 2000 F. [Manufacturer: Minneapolis-Honeywell Regulator Co., Brown Instruments Div., Wayne and Windrim Aves., Station 213, Philadelphia 44.]

Mechanical Draft Inducers

HPAC 123—Bulletin I-52, *Motorized Chimney Draft*, describes the advantages of mechanical draft inducers in supplying uniform draft. [Manufacturer: L. J. Wing Mfg. Co., Vreeland Mills Road, Linden, N.J.]

Metal Hose

HPAC 124—Catalog CMH — 130 covers complete line of "Rex-Weld" corrugated flexible metal hose, "Rex-Tube"



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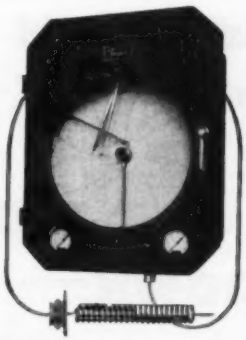
Taylor can help keep the air conditioned at the temperature you want, within very close limits.

We make a full line of accurate control instruments for practically every air conditioning need. And we'll be glad to work with you or your consulting engineers or contractors to find the answer to your individual problems. Ask your Taylor Field Engineer, or write Taylor Instrument Companies, Rochester, N. Y., and Toronto, Canada.



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No. 121RV120 is equipped with a special pre-formed capillary bulb designed for accurately measuring air temperatures. This controller precisely positions such devices as lever motors, diaphragm valves, dampers, etc., to produce the required air conditioning result. Available for on-off control, throttling control, or highly precise control; to reposition valves, lever motors or other pneumatically controlled devices.

Automatically compensates for changes in occupancy or processing loads.

Controls refrigeration compressors, automatically starting and stopping them according to the demand for artificial refrigeration.

Prepares for Summer or Winter changeover automatically by controlling fresh air and exhaust damper diaphragm valves.

Instruments for indicating, recording and controlling temperature, pressure, flow, liquid level, speed, density, load and humidity.

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(No. 7 Auto-Vent illustrated)

When installing an air vent on hot water heating systems, radiators, convectors, baseboard radiators, unit heaters, etc., be sure it's truly automatic. With Maid-O'-Mist Auto-Vents you can automatically vent out the air that causes circulation trouble and heating waste. More and more contractors who value satisfied customers are installing these trouble stoppers. No air chamber is required . . . quick and easy to install. For water pressure up to 75 lbs. See your jobber or write for data and attractive prices.

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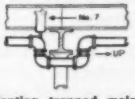

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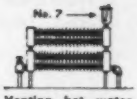

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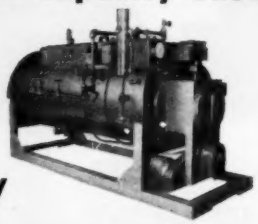

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convoluted hose types, and "Rex-Flex" stainless steel flexible metal hose. Coupling types and special assemblies are covered. Installation information is given. [Manufacturer: Flexonics Corp., 1330 S. Third Ave., Maywood, Ill.]

Motor Drives

HPAC 125—Bulletin AS-1600-B6 describes "Allspeed" motor drives of 1/3 to 7½ hp, and both upright and horizontal drives of either closed or skeleton types. Included are two pages of selection tables and dimensions and line drawings of the various drives. Write directly to the manufacturer on company letterhead for this bulletin. [Manufacturer: Worthington Corp., Harrison, N.J.]

Motors

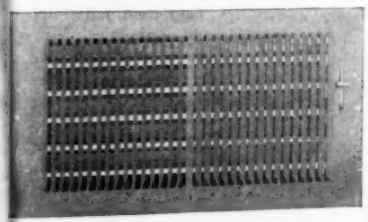
HPAC 126—Condensed price sheet, Form 943, shows price changes of various fractional and integral hp, single phase motors. This notice cancels that of July 1, 1951. [Manufacturer: Century Electric Co., 1806 Pine St., St. Louis 3.]

Oil Burner Controls

HPAC 127—Handbook OB-1952 on oil burner controls covers various types (blower, boiler, fan pressure limit controls, etc.) and contains specifications for wiring hookups for warm air, hot water or steam. Installation instructions and service hints are given. [Manufacturer: Mercoid Corp., 4201 Belmont Ave., Chicago 41.]

Pipe Line Strainer

HPAC 128—Pipe line strainer data manual No. 951 discusses functions, advantages, and factors affecting



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This Register Puts Air *Where You Want It!*

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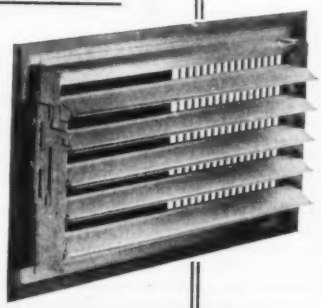
Adjustable Directional Flow Registers With Multiple Valves & Grilles

Here's an economically-priced register that gives you complete control over any forced air installation . . . either heating or cooling. The vertical face bars are cut on 1/3" centers . . . may be adjusted to deflect air in any direction. The horizontal valves on the rear are easily operated from the front. They provide positive deflection up or down. This register is equipped with a special compression gasket that forms a seal with the wall to prevent leaking and resultant smudges. Available in any length, heights of 4, 5, 6, 8 or 10 inches (and multiples of these heights). Choice of prime. Japanned or Lacquer finish.



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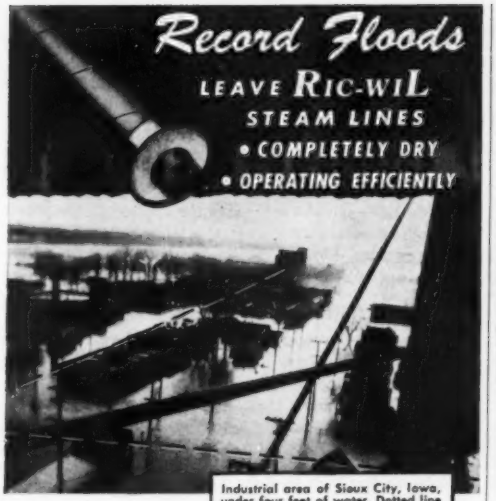

Industrial area of Sioux City, Iowa, under four feet of water. Dotted line indicates route of Ric-wiL 4" H.P. steam main.

The recent spring floods along the Missouri Valley areas presented excellent opportunity to test the water-tightness of Ric-wiL Insulated Piping Systems. Inundated by flood waters at several central heating installations in this area, Ric-wiL HEL-COR Conduit Systems remained entirely dry, with no damage to pipe and insulation — no loss in thermal efficiency!

At Sioux City, Iowa--

Mr. E. Rochester, Supt. of Steam Heating for the Iowa Public Service Co., advises: "After the flood subsided, we turned this 4" line back on and have no trouble with it. Steam mains (other than Ric-wiL) from Kirk station were completely submerged in water. Had it not been for the installation last year of a Ric-wiL 12" H.P. line, the entire downtown area would have been out of steam for several days."

At Marshall, Minn.--

Mr. M. C. Bright, Supt. of Utilities, reports: "Both this year and last year manholes were flooded. Last year the water covered parts of town served by the steam system for several days. Upon pumping and cleaning the manholes, no apparent damage had occurred to the Ric-wiL installation. We are satisfied with the ability of the Ric-wiL construction to resist manhole flooding without damage."

To provide this dependable, trouble-free operation for your steam distribution system, insist on Ric-wiL — highly efficient, permanent, prefabricated for quick, easy installation.

◄ Write for latest Catalog — or contact us for engineering assistance when your steam mains are in the design stage. ►

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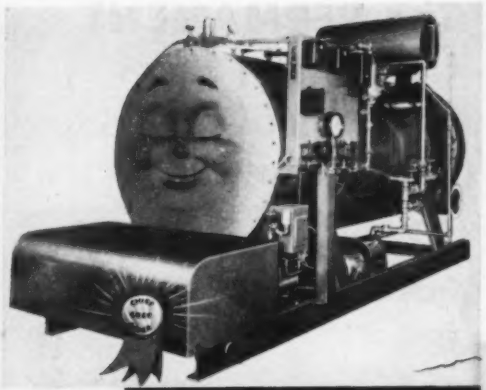
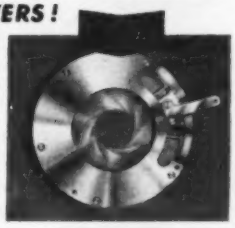
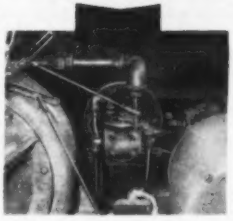


"OUR STEAM-PAK GENERATOR WAS REWARDED FOR CUTTING OUR COSTS $10,000 LAST YEAR"

Modern steam production with York-Shipley Steam-Pak Generators shows unbelievable savings in fuel, maintenance, and installation costs. For instance, an installation in the shops of middle western railroad paid for the installation and saved $10,000 during the first year of operation.

THESE STEAM-PAK *EXCLUSIVES* ARE *REAL COST SAVERS!*





Steam-Paks, the modern steam generators, built by York-Shipley, regulate themselves automatically by load demand, furnishing steam or hot water when required. The Iris Shutter air control (upper right) and Metering Oil Pump (lower right) supply the correct amount of air and oil as required by load demand. This means highest combustion efficiency, lower operating costs. Steam-Paks cover the full range from 15 to 300 hp. for low or high pressure steam or hot water and are fired by oil, gas, or a combination of oil and gas.

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YORK-SHIPLEY, INC.

INDUSTRIAL DIVISION, YORK 7, PA.

AUTOMATIC HEAT AND POWER SPECIALISTS SINCE 1918

selection of strainers. Dimensions, pressure drop charts, and other descriptive material are given for duplex strainers (plug, disc, and gate); sinlex strainers (offset, straight-thru, and multiple basket); special strainers (horizontal duplex, vertical and angle); and Y strainers. [Manufacturer: J. A. Zurn Mfg. Co., Industrial Div., Erie, Pa.]

Pumps, Blowers, and Other Equipment

HPAC 129—Booklet 300 gives the history of the plants and products of Ingersoll-Rand Co., illustrating such products as engines, blowers, refrigerating units, etc. [Publisher: Ingersoll-Rand Co., 11 Broadway, New York 4.]

Single Float Automatic Control

HPAC 130—Bulletin 3100 describes how the single float "Autocon Floatrol" control may be used to operate one to three circuits in sequence or in combination. Applications include open tanks and sumps in water, sewage and industrial processing. [Manufacturer: Automatic Control Co., 1005 University Ave., St. Paul 4.]

Standards for Butt Welds

HPAC 131—Standard ESI-1952, *End Preparation and Internal Machining for Machined Backing Rings for Butt Welds*, replaces standard bulletin issued four years ago. The revised standard meets present-day high pressure and high temperature piping requirements and includes design changes that minimize the amount of weld metal required and the resultant shrinkage stresses in the weld. [Publisher: Pipe Fabrication Institute, 811 Clark Bldg., Pittsburgh 22.]

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CAST-IN-PLACE CONDUIT CONSTRUCTION

Z-CRETE is a lightweight insulating concrete which is poured monolithically around heated underground piping—insulates any size, number or arrangement of pipes. Contains no joints, no voids. Z-CRETE is as permanent as the earth itself!

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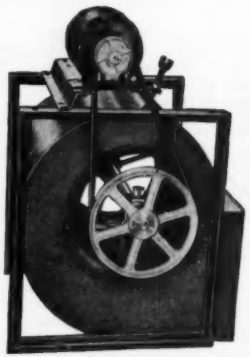

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and other applications which HAVE proved that this modern method of snow removal

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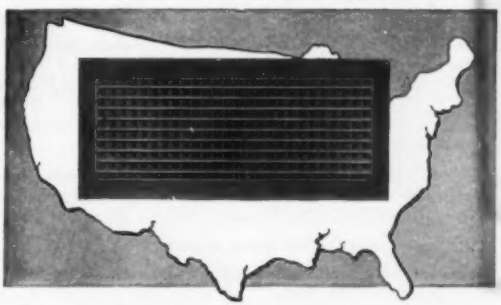

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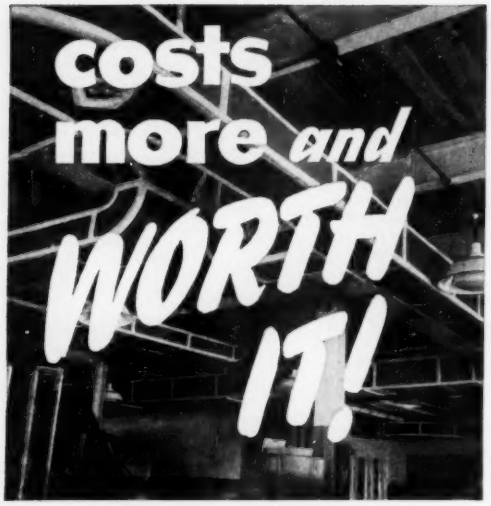

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HPAC 132—Booklet describes the factory-assembled "VL" steam generator, combining two horizontal drums with integral water cooled furnace, brickwork, insulation, and a complete steel casing. Line drawings, photographs and cut-away drawings are given to explain the mechanics of the various models (for underfeed or spreader stoker, oil or gas). [Manufacturer: Erie City Iron Works, 1450 East Ave., Erie, Pa.]

Swing Check Valves

HPAC 133—Bulletin BV-2 illustrates and describes a complete line of cast steel swing check valves. Included are descriptions of construction features, materials, flange facings and a condensed data sheet. [Manufacturer: Brown Valve Div., Vernon Tool Co., Ltd., 1101 Meridian Ave., Alhambra, Calif.]

Tankless Water Heater

HPAC 134—Data sheet offers condensed information on dimensions and mechanical features of the Series T cast iron tankless water heater. [Manufacturer: Alstrom Corp., 790 E. 176th St., New York 60.]

Thickness of Coatings

HPAC 135—Folder describing theory and operation of "Coatingage" Model 600. This portable instrument is used to measure the thickness of non-magnetic coatings on magnetic bases and to detect pin holes in non-conductive coatings on conductive bases. Among its uses is the examination of corrosion-protection coatings. [Manufacturer: Branson Instruments, Inc., 430 Fairfield Ave., Stamford, Conn.]

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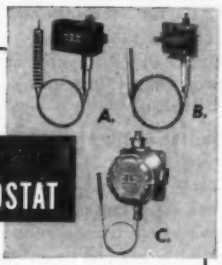

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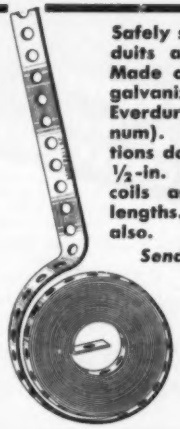
MINERALLAC *Perforated* STRAP *Versatile Hanger Iron*



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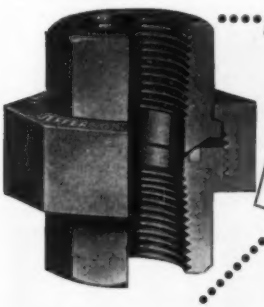

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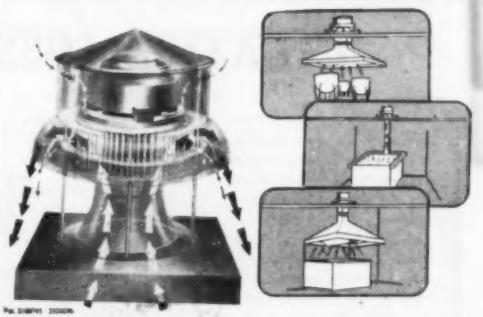

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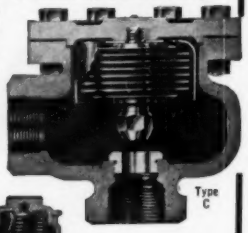

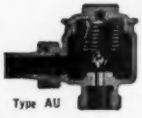

BULLETIN 152
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HPAC 136—Brochure (20 pages) describes 13 installations of "Platecoil" coils used in heating and cooling processes. [Manufacturer: Kold-Hold Mfg. Co., Lansing 4, Mich.]

Water in Air Conditioning Systems

HPAC 137—Bulletin describes the use of recirculated water in the component parts of air conditioning systems such as cooling towers and evaporative condensers. Recommendations are given for overcoming operating troubles arising from the impurities that are present in all natural waters. [Manufacturer: Water Service Laboratories, Inc., 423 W. 126th St., New York 27.]

Water Level Controls

HPAC 138—Bulletin (23 pages) contains line drawings, photographs, price lists and specifications for safety devices for steam and hot water boilers. Those products include boiler water feeders, make-up water feeders for receivers, low water fuel cut-offs, pressure relief valves, temperature relief valves, float operated switches, small float valves, solvent still regulators and flow switches. [Manufacturer: McDonnell & Miller, Inc., 3500 N. Spaulding Ave., Chicago 18.]

Welding and Cutting Units

HPAC 139—Bulletin 330 illustrates and describes units for flame cutting, heating and welding. Photographs, specifications and prices are given. [Manufacturer: Victor Equipment Co., Welding Equipment Div., 844-54 Folsom St., San Francisco 7.]

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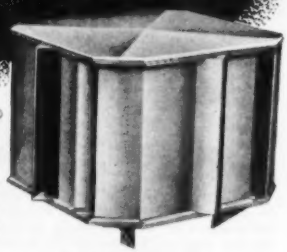

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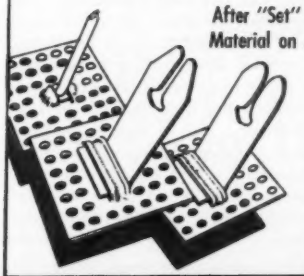

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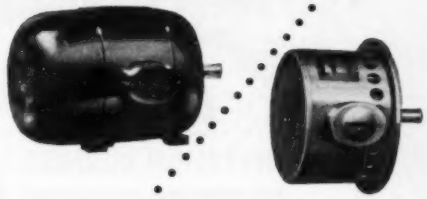

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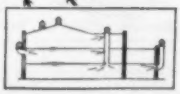

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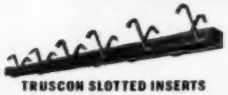
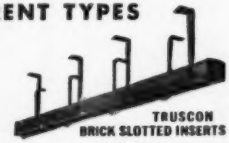


TRUSCON SLOTTED INSERTS



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Welding Electrodes

HPAC 140—Booklet GED-1634 describes application, chemical analysis and mechanical properties of welding electrodes. [Manufacturer: General Electric Co., Schenectady 5. Available from the company's welding distributors.]

Welding of Stainless Steel

HPAC 141 — Welding with Stainless Steel Electrodes is a 32-page booklet containing reprints of material from the Procedure Handbook of Arc Welding Design and Practice. It covers welding of chromium-nickel steels, with and without molybdenum, as well as welding of straight chromium steels, with complete procedures. For the welding of the austenitic type of chrome-nickel steels, data is included on non hardenability, work hardening, carbide precipitation, methods of preventing carbide precipitation, unstabilized steels, stabilized steels, electrodes, chromium loss, heat conductivity, melt-off rate, electrical resistance, thermal expansion, use of copper backing, cleaning and weld defects. An analysis, physical properties, use and welding procedures are included for most of the types of such steels. In addition, there are listed the A.W.S.-A.S.T.M. classifications of corrosion-resisting chromium and chromium nickel steel welding electrodes (Specification A298-48T).

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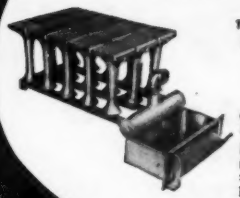

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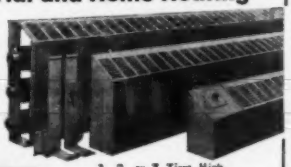

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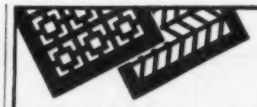

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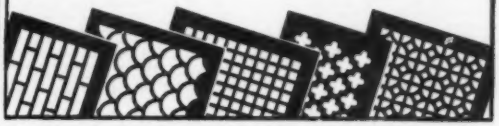

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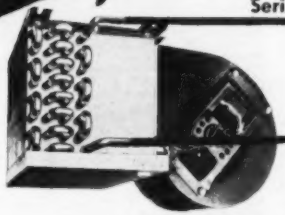

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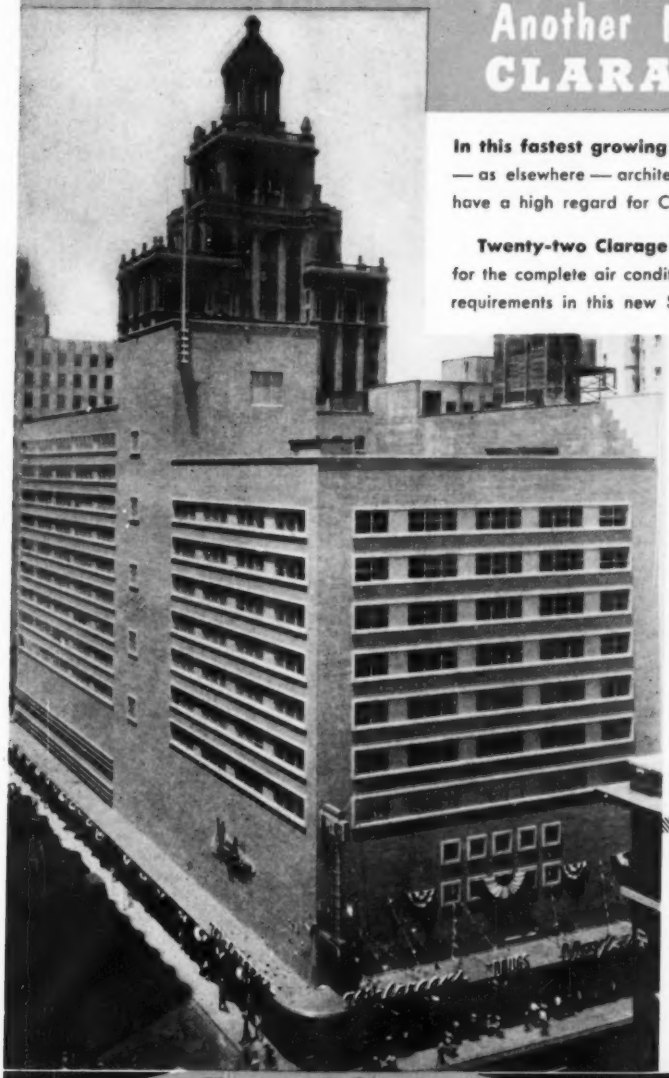

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Steam Rated on Pressure Side
Fully Automatic Reseating

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Two fully-tested valves in one . . .

Yes, for pressure relief the 202 Series utilizes the operating mechanism of the McDonnell 230 series. This means that the pressure relief capacities (listed below) are *steam rated* in Btu's./per hr. in accordance with accepted procedure — the only way to match discharge capacity of a pressure relief valve to the Btu. output of a heater, thus precluding over-pressure under any and all emergency conditions. In fact, the 202 is the *only* T & P valve in which the pressure side is steam rated!

And for temperature relief the No. 202 embodies the operating mechanism of the No. 201 temperature relief valve . . . which means accurate response to temperature; powerful and positive opening; drip-tight reseating when temperature is under control. It means all this because the mechanism has the Vernatherm element which starts to open at precisely 188°F.; opens up to full capacity in a twenty degree rise; reseats tightly when temperature drops to 183°F.

Also because the 202 series contains the 201 unit, it has the ¾" tapping for piping to fixtures which directs the service flow water through the body of the valve as diagrammed opposite. This is a real innovation. It cuts installation costs; it eliminates any air in the valve chamber; and, still more important, it keeps the temperature element subjected to service-water temperature, assuring control of the water temperature *as used*.

A new bulletin tells the whole story of the 202 series. Ask for it.

McDonnell & Miller, Inc., 3500 N. Spaulding Ave., Chicago 18, Ill.

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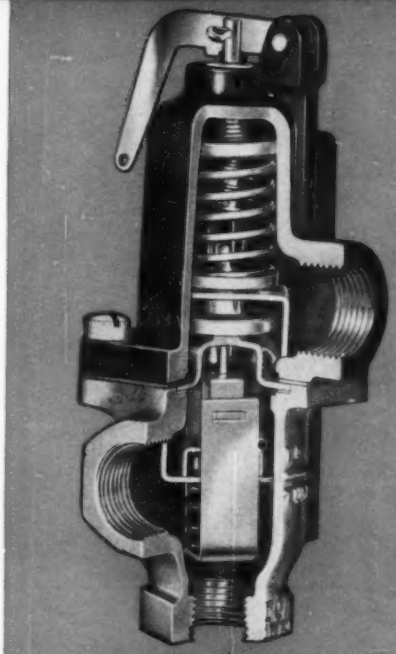
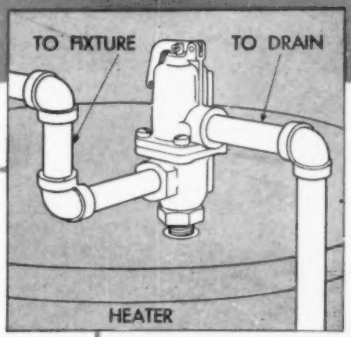
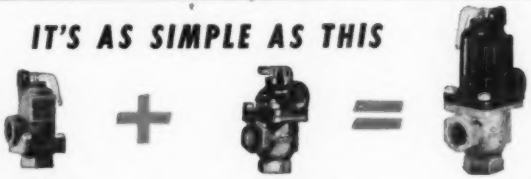




Note fixture tapping for taking service water through the body of the valve.

IT'S AS SIMPLE AS THIS



No. 230 Pressure Relief Valve	No. 201 Temperature Relief Valve	No. 202 T & P Relief Valve

You know what the 230 and 201 represent individually; so you know what they can do together in the 202!

Pressure relief capacities of the 202 series based on *steam discharge* are:

T & P Valve number	Opening pressure	Capacity Btu./hr.
202 - 75	75 lbs.	410,000
202 - 100	100 lbs.	527,000
202 - 125	125 lbs.	644,000

Temperature relief capacity of all No. 202 series T & P valves, based on hot water discharge, is 725,000 Btu./hr. (A G A tested and rated) Operating range of heating element: 188° — 208°F.

Your Jobber Stocks Them

McDONNELL *Boiler Safety Devices*